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Summer 2004

Logistics Dimensions

Improving Bare Base Agile Combat Support

The Path to Integration

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Creative Approaches to Improving Segments of the Defense Transportation System

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Special Feature

Much of the existing support equipment is heavy and not easily transportable; deploying all the support for almost any sized AEF from the CONUS to an overseas location would be expensive in both time and airlift. As a result, the Air Force has focused on streamlining deploying unit combat support processes, leaning deployment packages, and evaluating different technologies for making deploying units more agile and quickly deployed and employed.

logistics dimensions

Improving Bare-Base Agile Combat Support: A Comparative Analysis Between Land Basing and Afloat Prepositioning of Bare-Base Support Equipment

The Path to Integration: A Look at the Past, Present, and Potential Future of Integrating Reserve and Active Flying Units

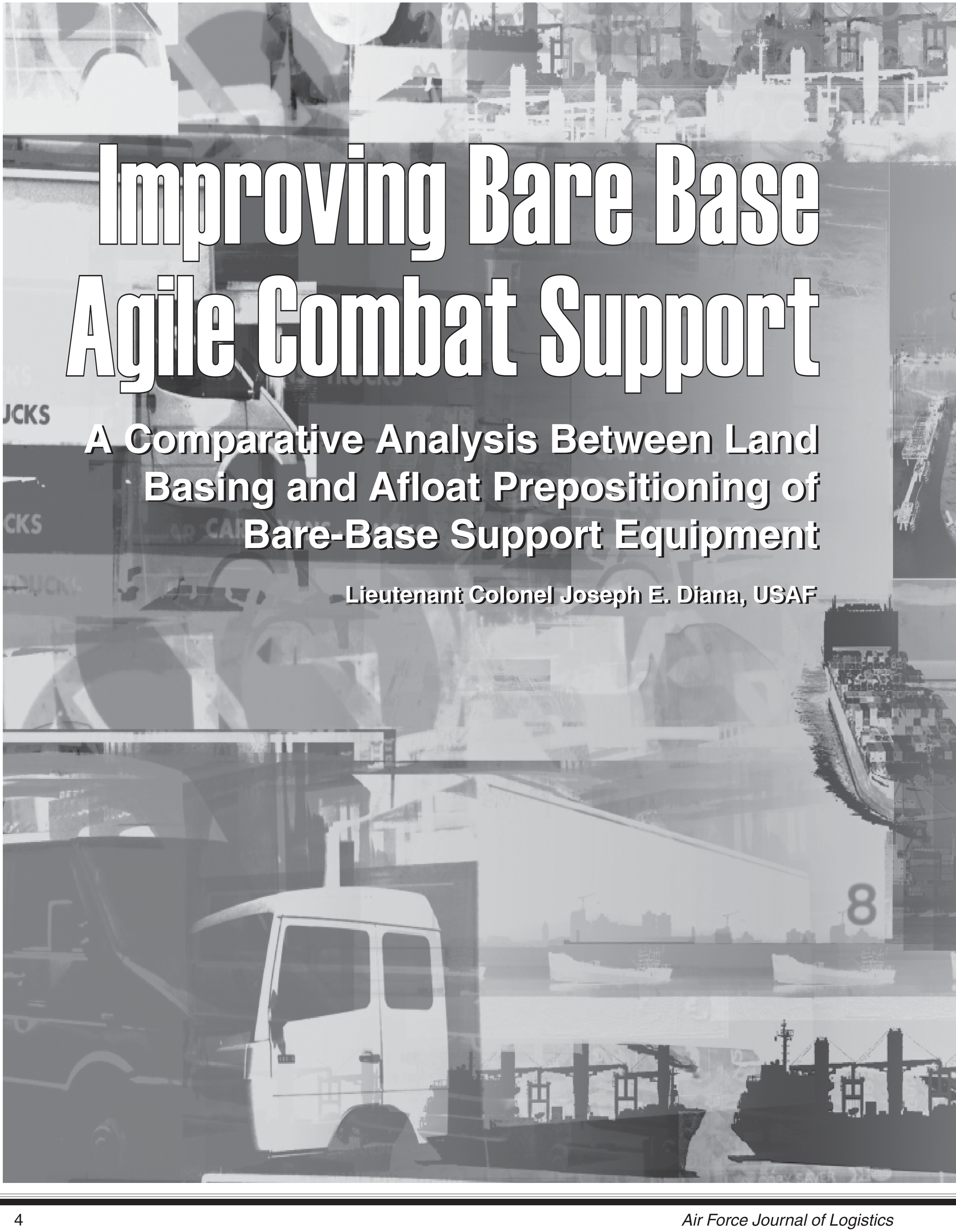
To meet current and anticipated challenges, the Air Force has developed an air and space expeditionary force (AEF) concept that has two primary goals. The first is to improve the ability to deploy quickly from the continental United States (CONUS) in response to a crisis, commence operations immediately on arrival, and sustain those operations as needed. The second goal is to reorganize to improve readiness, better balance deployment assignments among units, and reduce uncertainty associated with meeting deployment requirements. The underlying premise is that rapid deployment from CONUS and a seamless transition to sustainment can substitute for an ongoing US operations. Two organizations, RAND and the Air Force Logistics Management Agency, have individually and collectively examined the key support concept—Agile Combat Support —that underpins the ability to conduct expeditionary operations.

Early attempts at integrating active Air Force and reserve component units met with failure, resulting in nearly a decade's passing before any effort in this area was made again. To meet the vision of the Future Total Force concept, efforts have been underway at Robins AFB, Georgia to bring elements of the active and reserve components together. With a year of experience, the Robins Model will be used as a roadmap to integrate other units. Integration efforts will be problematic to both the operations and logistics communities.

Improving Bare Base Agile Combat Support

A Comparative Analysis Between Land Basing and Afloat Prepositioning of Bare-Base Support Equipment

Lieutenant Colonel Joseph E. Diana, USAF



In a tale of war, the reader's mind is filled with the fighting. The battle—with its vivid scenes, its moving incidents, its plain and tremendous results—excites imagination and commands attention. The eye is fixed on the fighting brigades as they move amid the smoke, on the swarming figures of the enemy, on the general, serene and determined, mounted in the middle of his staff. The long trailing line of communications is unnoticed. The fierce glory that plays on red, triumphant bayonets dazzles the observer, nor does he care to look behind to where, along a thousand miles of rail, road, and river, the convoys are crawling to the front in uninterrupted succession. Victory is the beautiful, bright coloured flower. Transport is the stem without which it could never have blossomed.

—Winston Churchill

Special Feature

Introduction

Air Force guidance is rife with statements on the importance of its expeditionary capability. As an example, in the 2003 Air Force Posture Statement, the term expeditionary occurs 30 times. In spite of a 30-percent reduction in service manpower over the last 12 years, the Air Force has experienced an exponential increase in worldwide taskings.[1] Deputy Secretary of Defense Paul Wolfowitz, in a prepared statement before the House and Senate Armed Services Committees, 3-4 October 2001, acknowledged the impact from the events of 11 September 2001 and the subsequent security environment. He stated, "A transformed force must be able to…project and sustain forces in distant access-denial environments." Two Air Force distinctive capabilities—rapid global mobility and agile combat support (ACS)—focus efforts further on making the Air Force as expeditionary as possible.[2] The term expeditionary is not specifically defined in Air Force doctrine but is understood to describe a capability to deploy rapidly anywhere in the world, quickly establish operations, and sustain those operations for as long as necessary. RAND's analysis of Air Force efforts in Operation Enduring Freedom and Operation Iraqi Freedom highlighted the challenges associated with rapidly deploying forces and initiating combat operations. This critique of the Air Force is not new. The Air Force has struggled with expeditionary operations since becoming a separate service. In the Korean and Vietnam conflicts, the Air Force's inability to deploy quickly and operate with a focused footprint resulted in the displeasure of the Secretary of Defense.[3] As a result, the Air Force began to develop a better expeditionary capability. The Harvest Bare concept was born and has evolved into a robust, mobile expeditionary capability. Today, the Air Force has a variety of bare base assets that can be tailored to meet service needs across the spectrum of conflict.

Yet, while these assets remain mobile, they are not agile, and the current prepositioning strategy is focused mainly on two regions of the world—the Korean peninsula and Southwest Asia. To improve Air Force agility in establishing bare-base operations, RAND and the Air Force Logistics Management Agency (AFLMA) analyzed current conditions separately and recommended potential solutions. RAND's focus has been more on improving agile combat support and centered on establishing forward operating locations (FOL) and forward support locations (FSL).

While their research is not focused on staging bare-base assets, using forward support locations puts key bare-base assets within 3,000 miles of any geographic location. Conversely, AFLMA focused its research on adding a sealift component for bare-base assets similar to the concept currently used for munitions. Its research centered on a cost-and-risk analysis comparing ship-basing and land-basing of bare-base assets. These two studies provide key strategies for improving the Air Force's ability to rapidly project expeditionary air forces anywhere in the world. This article compares the results of these two studies to determine which is the best option for meeting the needs of the expeditionary air force.

The yardstick used to make that determination should be based on stated requirements for the Air Force. Those requirements start with the National Security Strategy and flow down to Air Force doctrine and keystone publications. Distilling those many documents results in four key areas for evaluation: responsiveness, readiness, supportability, and cost.

To improve Air Force agility in establishing bare base operations, RAND and the Air Force Logistics Management Agency analyzed current conditions separately and recommended potential solutions.

Background

We move on time lines that simply will not work if we have to wait for support for our expeditionary forces.

—General Ronald R. Fogleman, USAF

Air Force Requirements for Bare Basing

Requirements for an agile bare-base concept for the Air Force exist in a variety of documents. The National Security Strategy requires the Department of Defense (DoD) to continue to transform the military forces to ensure the ability to conduct rapid and precise operations anywhere in the world to achieve decisive results.[4] The 2003 Air Force Posture Statement reminds airmen that the nature of the Air Force is not home-station operations but deployed operations.[5] In 2003, the Air Force was deployed to more than 40 countries.[6] But where do these forces deploy? It has been more than a decade since the DoD began reducing overseas main operating bases. In the 1990s, primary expeditionary operations were to warm[7] forward operating bases like Prince Sultan AB, Saudi Arabia, or Incirlik AB, Turkey. However, Enduring Freedom and Iraqi Freedom saw operations move to much more austere locations like Bagram AB, Afghanistan, and Ganci AB, Kyrgyzstan. The authors of the RAND study *Supporting the EAF: A Global Infrastructure* call these *category 3* bases where the main assets are a runway, source of water, and source of fuel.[8] The Air Force will continue to project power to these category 3 bases for the foreseeable future.

Projecting power to these category 3 bases requires bare-base assets. Bare-base assets include three main components. First and foremost are the *Harvest* sets that provide living and working shelters and the utility infrastructure to sustain operations. There are currently five types of Harvest sets, and they can be scaled to meet Air Force requirements across the spectrum of conflict. The largest Harvest set can support 1,000 persons and requires more than 250 trucks to move. In addition to the Harvest sets, special purpose vehicles and equipment are needed. These include R-9 refueling trucks, airbase defense vehicles, emergency response vehicles, and construction vehicles needed to set up a base. The last major component for bare-base operations is the special purpose equipment. Special purpose equipment includes aerospace ground equipment, munitions materiel-handling equipment, and equipment needed by civil engineers. These three components comprise the basics of any bare-base capability but are not all-inclusive. Munitions, external tanks, munitions racks, and adapters, as well as bulk petroleum, are other key components to sustaining combat sortie operations. The focus of this article, however, is on the bare-base components of Harvest sets, special purpose vehicles, and special purpose equipment and the best way to store and maintain these items so they can be rapidly deployed to support combat operations.

Being Expeditionary

Based on the presence of Air Force units deployed to 44 deployment locations in 2003, no one can argue the expeditionary nature of the Air Force. However, being able to project forces is only one part of being expeditionary. The Air Force must be able to project those forces rapidly. The current air and space expeditionary force (AEF) goal—establishing combat sortie operations at any bare-base location in the world 5 days after the deployment starts—constitutes a challenge that the Air Force has yet to overcome.[9] For example, for various reasons, not a single Enduring Freedom location was able to achieve this goal. Even with some bases in the region having US forces present and others possessing little more than a runway, the Air Force struggled to become operational quickly. Diego Garcia, a base well known to Air Force units and operated by the British Royal Air Force, was operational in 17 days. Units deployed to Jacobabad, Pakistan, required 73 days to prepare the site, establish force protection measures, repair deteriorating parking ramps, set up communications, and construct munitions

pads, as well as a tent city.[10] RAND's analysis of the Air Force's ability to rapidly deploy raises concern.

A Look at Two Proposals

The RAND Corporation and AFLMA each have conducted extensive research to help identify ways to make the Air Force more expeditionary.

RAND Corporation Study

RAND conducted a series of studies evaluating the ACS capabilities of the Air Force. The focus of these studies was not limited to initial operations at bare bases but also included sustainment of combat operations. RAND's primary contention was that five basic components could best serve agile combat support: forward operating locations, forward support locations, continental United States (CONUS) support locations, a responsive transportation system, and a combat support C2 system.[11] RAND divided the forward operating locations into three categories based on their infrastructure:

- A **category-3** forward operating location is a *bare base*. It meets only the minimum requirements to operate a small fighter package (runway, fuel, and water). It would take almost a week (144 hours) to be able support aerospace expeditionary wing (AEW) high-sortie generation rates.
- A **category-2** base has the same support facilities as a category-3 base plus prepared space for fuel storage facilities, a fuel distribution system, general-purpose vehicles (host-nation provided or rented), and basic shelter. It may take up to 96 hours before a category-2 base could support AEW high-sortie generation rates.
- A **category-1** base has all the attributes of a category-2 base, plus an aircraft-arresting system and munitions buildup and storage sites already set up, and 3 days' worth of prepositioned munitions. Such a base could be ready within 48 hours of the execution order to support high AEW sortie generation requirements.[12]

Because each category of forward operating location requires differing amounts of equipment to prepare the base for operations, RAND proposed two options for supplying these resources: forward support locations in or near the theater of operations and CONUS support locations.

> An FSL can be a storage location for US war reserve materiel (WRM), a repair location for selected avionics or engine maintenance actions, a transportation hub, or a combination thereof. It could be staffed permanently by US military or host-nation nationals or simply be a warehouse operation until activated. The exact capability of a forward support location will be determined by the forces it will potentially support and by the risks and costs of positioning specific capabilities at its locations.[13]

RAND, in a subsequent study, refined the FSL concept with specific recommendations for locations (Figure 1):

> A small number of forward support locations in Alaska, Guam, Puerto Rico, Diego Garcia, and the United Kingdom could put most of the world within range of a C-130 carrying a 12-ton payload of supplies and equipment. Those in Alaska, Guam, and Puerto Rico, being on sovereign US territory, would offer assured access. Assured access is available on Diego Garcia until at least 2039. Forward support locations in the United Kingdom do not offer completely assured access, but they would be on the territory of the most reliable US ally.

Article Highlights

Base-base operations and bare-base assets are key to making expeditionary airpower and agile combat support a reality. This article compares the recommendations of two separate agile combat support study efforts and offers an overall recommendation concerning the best choice based on responsiveness, readiness, supportability, and cost. The first study, conducted by RAND, focused on improving agile combat support by suggesting network of land-based sites—forward support locations. The second study, conducted by the Air Force Logistics Management Agency, takes a different tactic. It suggests adding a prepositioned sealift component for bare base assets similar to the one currently used for munitions. These two studies provide key strategies to improve the Air Force's ability to project expeditionary airpower rapidly anywhere in the world. The focus of this article is determining the best option for meeting the needs of the Air Force. It advocates that an afloat option has sufficient merit across the spectrum of readiness, responsiveness, supportability and cost to make it the better choice.

While RAND and the AFLMA offer differing views concerning bare-base assets, they have worked collectively under the sponsorship of the Air Staff on a variety of ACS efforts.

All would be outside the range of the offensive capabilities of likely future adversaries.[15]

In sum, this geographic arrangement using forward support locations is the basis of this article for analysis of a future support system for bare-base equipment staging.

AFLMA Study

In contrast to RAND's land-based recommendations for forward support locations, AFLMA conducted an analysis on an afloat prepositioning concept for bare-base assets. The study had four primary purposes. First, complete a two-part cost-benefit analysis consisting of an analysis of day-to-day peacetime operations and a similar analysis of wartime requirements between the Air Force's current land-based prepositioning posture and a combination of land-based and afloat prepositioning posture. Second, develop a decision support tool to determine when to use assets prepositioned on ships. Third, compile information on how well assets are maintained on both Army and Marine Corps prepositioning ships. Finally, compile reliability data on Military Sealift Command (MSC) prepositioning ships.[16] Their analysis was based on the beddown of a single air expeditionary wing.

They concluded that, during peacetime, expenditures for afloat prepositioning exceeded those for land-based prepositioning but, during wartime, the ship-based concept quickly paid for itself. In terms of force closure timing, analysis indicated that equipment aboard the ships was delivered to the operating location within required time lines. The net impact of the nonmunitions WRM afloat prepositioning ship shortened force closure timing by 1 to 2 days over the first 15 days of the operation. Finally, with regard to affordability, purchasing $71M in new equipment to simply put on the ship was deemed to be cost prohibitive based on past Air Force WRM appropriations.[17]

AFLMA refined the study in April 2003 to further examine the risk to Central Command's operational plans (OPLAN 1003-98) to place nonmunitions WRM afloat and presented an implementation plan for sourcing the assets to be stored on the ship from currently assigned WRM assets.[18] The resources identified were US Central Command's (CENTCOM) assets that were malpositioned (not stored at the right location or in excess of requirements). This sourcing was done to overcome the issues with affordability of the $71M in equipment needed to configure the ship. They continued to recommend a minimum of at least one, possibly two, ships dedicated to nonmunitions WRM items.

Evaluation Criteria

Which of the two studies discussed best meets the Air Force needs? As previously discussed, Air Force capabilities flow from the *National Security Strategy* and the *National Military Strategy.* These two documents stress the importance of quickly responding to world events. Therefore, responsiveness is a key criterion. Responding quickly is a function of readiness. Readiness is the second criterion. The fiscal realities of today's budget environment require any capability to be affordable and sustainable. This leads to the final two criteria: supportability and cost. Therefore, four criteria will be used for evaluation: responsiveness, readiness, supportability, and cost. Identifying the criteria requires an explanation of what considerations are involved in each.

Responsiveness

Responsiveness measures the ability of each option to meet requirements driven by contingency taskings. Taskings should not be limited to specific operational plans but should consider the possibility of worldwide contingencies or deployments. Evaluation of this capability must consider a potential adversary's antiaccess measures. It must consider secondary transportation requirements to deliver bare-base assets to their ultimate destination. Finally, how quickly an option can be implemented must be evaluated.

Readiness

The concept of readiness includes the level of maintenance support required to keep bare-base assets ready for use in each option. This includes how frequently maintenance will be performed and how accessible the assets will be for maintenance actions under each option. Readiness analysis will consider how successful the maintenance program would be in terms of access to skilled technicians, spare parts, and the impact of environmental factors on the items. Finally, readiness will

Coverage Available from Five FSLs. Most of the world is within a 3,000-mile radius from one of these five potential FSLs, putting most of the world within the operating range of a C-130.

Figure 1. Forward Support Locations Providing Global Coverage[14]

consider how visible and measurable the assets will be to senior leaders under each option.

Supportability

The criterion of supportability measures the ability of the Air Force to sustain either option over time. As mentioned before, a component of responsiveness should evaluate how quickly each option can be implemented fully. In measuring supportability, assessments will be made as to how likely Congress, combatant commanders, and the Services will be in supporting each option.

Cost

Cost is the final criterion. The peacetime costs involved in each option will be assessed. This will be focused primarily on the cost to initiate and sustain each option. Additionally, this article uses a comparison of the wartime cost for each option. Where pertinent, costs will be divided into fixed and variable components to help better determine which option is more economical.

Evaluating the Two Options

> *Streamlined infrastructure, time-definite delivery, total asset visibility, and a reduced mobility footprint are the four overarching planks of agile combat support. They're all focused on being able to "get out of Dodge" rapidly with resupply and sustainment starting as the force is ready to engage.*
>
> **—Lieutenant General William P. Hallin, USAF**

Air Force capabilities flow from the *National Security Strategy* and the *National Military Strategy.* These two documents stress the importance of being able to respond to world events quickly.

Having provided a brief description of the two plans for bare-base storage and the four criteria by which the two plans will be evaluated, it is now time to compare the two. Each option will be evaluated against specific criteria.

Responsiveness

AFLMA provides an excellent comparative analysis of the responsiveness of afloat prepositioning and movement of theater, land-based assets. The theater locations used by AFLMA do not specifically match the FSL locations proposed by RAND. However, they provide an excellent starting point for analysis and are actually closer to the conflict locations evaluated than any of RAND's proposed forward support locations. AFLMA analysis used two different criteria for comparison. First, they used specific locations identified in CENTCOM's OPLAN 1003-98 for comparison. Second, they chose a variety of contingency locations throughout the theater that were not tied to an operations plan.

For the first part of the analysis, AFLMA chose eight OPLAN Air Force locations that would require the delivery of bare-base assets. The locations are identified by number to address classification considerations. Also, because required delivery date (RDD) information is classified, the team developed an unclassified measure based on the force closure times. This measure compares the percentage of required delivery dates met rather than the actual time it took to deliver the assets. Four transportation scenarios were run for each location. The scenarios and their justifications were:

- **Airlift**—airlift from the land-based source to the forward operating location. Only one transportation leg is involved.
- **Afloat**—In this option, the first transportation leg is sealift from tether (Diego Garcia) to port. The second leg is download port time at the destination port. The final leg is truck to the final destination.
- **Afloat Worst**—For the worst-case scenario, the team assumed port access was denied forcing the war reserve materiel to be downloaded at Diego Garcia and airlifted to the forward operating location. AFLMA recognized that one shortfall with this scenario was that it ignored the intermodal problem; that is, sealift and land utilize 20- or 40-foot containers, and airlift requires 463L pallets. For analysis, they assumed away the intermodal problem but recommended it for further study.
- **Theater Sealift**—US Central Command Air Force (CENTAF) planners informed AFLMA that, as a result of lessons from Iraqi Freedom, intratheater airlift for bare-base assets does not work. Prior to the start of hostilities, CENTAF moved bare-base assets exclusively by theater sealift. This option contained five transportation legs. The first leg trucked the equipment from source (the forward support location) to a port. The second leg was to be at port in time for loading. The third leg was sealift. The fourth leg was the download at the destination port. The final leg trucked the equipment to the final destination.[19] The results of AFLMA's analysis is depicted in Figure 2.

AFLMA offered the following comments on the results:

> The results showed that, even with no strategic warning, many of the combatant commander's requirements can be met with equipment prepositioned afloat. The only locations where theater prepositioning offers an advantage is when airlift is the only option for movement—Bases 5, 6, and 7. Further analysis showed that the risk to the afloat option at these locations could be reduced to levels equal to that of the airlift option by either (1) securing additional line haul capability or (2) taking advantage of ambiguous warning. At Bases 5 and 6, using rail or additional line haul capability allows the afloat option to close as fast as the airlift option. At Base 7, only 4 days of ambiguous warning are needed to allow the afloat option to close as fast at the airlift option.
>
> Analysis of past contingencies in the previous study showed that it is not unrealistic to assume that there will almost always be some degree of strategic warning prior to a contingency.[21]

In recognition of this assumption, additional analysis was performed with 7 days of strategic warning. The results are shown in Figure 3.

In summary, a comparison of prepositioned afloat and airlift in scenarios with and without strategic warning is shown in Table 1.

While OPLAN analysis is important, the Air Force deployment pattern has been more contingency driven than OPLAN specific. For the second part of the analysis, AFLMA chose a variety of non-OPLAN-specific locations within the CENTCOM area of responsibility (AOR). For the northern part of the AOR, AFLMA chose Bishkik, Kyrgyzstan; Dushanbe, Tajikistan; Kulyab, Tajikistan; Samarkund, Uzbekistan; Qarshi, Uzbekistan; Jacobabad, Pakistan; and Bagram, Afghanistan. For the southern part of the AOR, AFLMA* chose Cairo West, Egypt; Asmara, Eritrea; Djibouti, and Mombassa, Kenya. AFLMA chose specific ports of entry in each region to help focus its analysis.

For the southern region, the results are shown in Figure 4.

> For the southern FOLs in the CENTCOM AOR, the afloat option overall closes faster than the airlift option, even with the overly restrictive assumptions for sealift and the overly optimistic assumptions for airlift. And clearly, the closer a port is to the destination location, the faster the afloat option can close. For example, Cairo West is approximately 100 miles from Port Suez; and under the constraint of 12 tractor-trailers for line haul, the line-haul time is 21 days of the total 33 days required for closure. As the 12 tractor-trailer constraint is relaxed (that is, contracted line haul from host-nation support), the closure time dramatically shortens.[24]

AFLMA gave an alternative in its analysis of the northern region locations. This was added because the time required to truck WRM from the port to the operating location was not acceptable. This alternative, the afloat + option, requires five C-17s to airlift the material from the disembarkation port to the operating location.[25] The results of this analysis are shown in Figure 5.

> The closure times for the northern locations are driven by the restrictive assumptions on ground transportation. The fact is, these locations are not near ports. There are no good ground transportation options—simple railroad routes are not as available for these locations as for the other locations analyzed.[26]

AFLMA's studies show that an afloat option is more capable of meeting force closure times than a land-based option, especially when some degree of strategic warning is received. In light of the fact that basing rights and overflight issues have to be resolved prior to any non-major theater war (MTW) event, it probably is realistic to expect that combatant commanders will have the foresight to get a ship headed toward its destination prior to the execution order.

AFLMA's analysis of closure estimates highlights that, regardless of the option, there

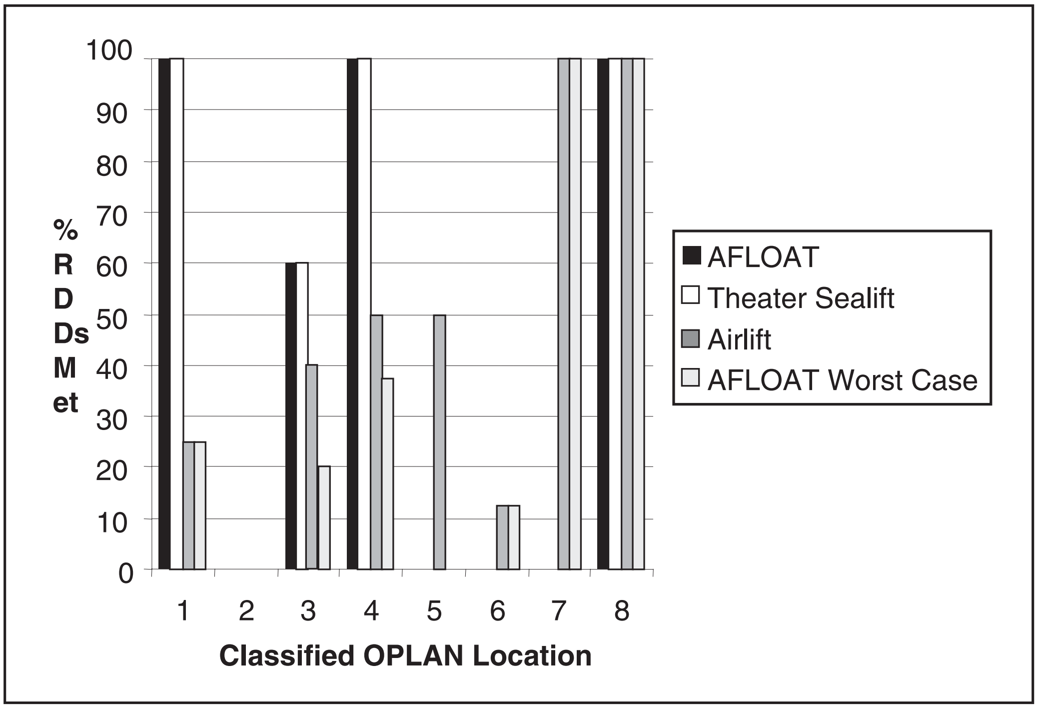


Figure 2. RDD Comparison Using Eight OPLAN Classified Locations (Without Strategic Warning)[20]

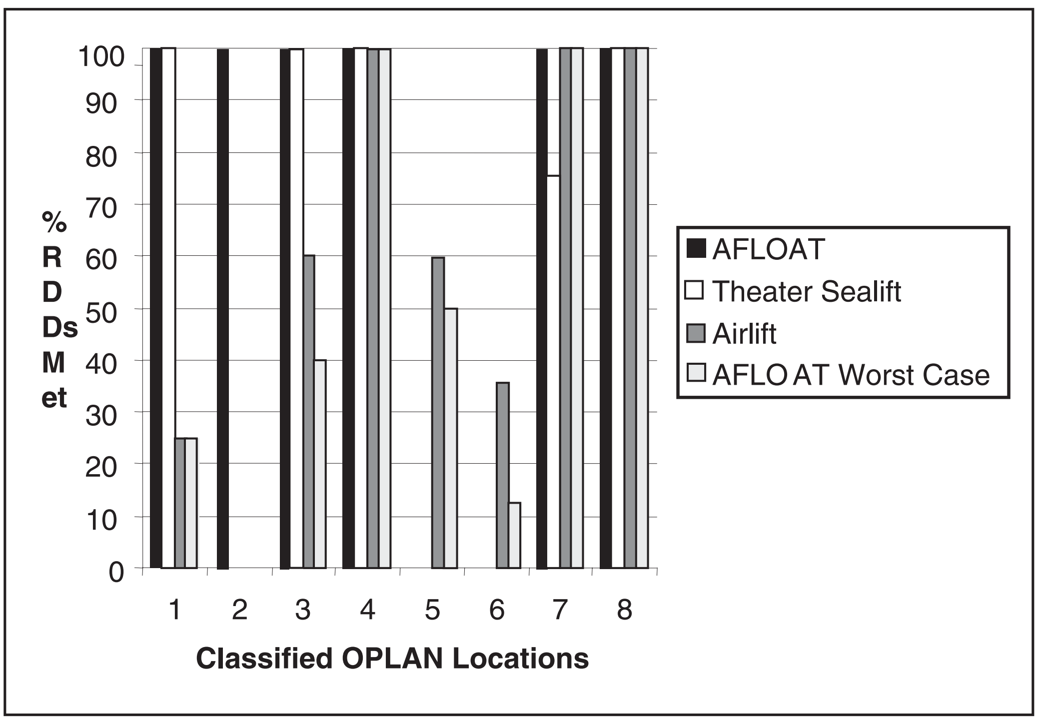


Figure 3. RDD Comparison with 7 Days of Strategic Warning[22]

undoubtedly will be secondary transportation requirements. Those secondary transportation requirements have a bearing on the overall responsiveness of each option. The more secondary transportation legs required, the more opportunity for friction to impact success. In the purest case, a land-based location would be able to airlift its assets directly to the bare base. This involves a four-leg transportation concept (storage to truck, truck to airlift, airlift to truck, truck to destination).[27] However, as noted earlier, experience has shown that the limited availability of airlift means a more likely transportation scenario for land-based assets would be sealift. Using sealift for land-based assets results in a six-leg transportation scheme (storage to truck, truck to port, port to ship, ship to port, port to truck, truck to destination). Ship-based assets, in the best-case scenario, would require a three-leg transportation model (ship to port, port to truck, truck to destination). In a worst-case scenario, the assets would have to be downloaded at a port outside of the AOR and then airlifted. This would require a five-leg transportation model (ship to port, port to truck, truck to airlift, airlift to truck, truck to destination). Based on these results, afloat prepositioning would seem to require less secondary transportation in both a best-case and worst-case scenario.

Responsiveness considers how quickly each option can be implemented. Of the five forward support locations RAND identified, the Air Force already has facilities at each location. However, any WRM storage location would require two to three large warehouses with maintenance and office facilities. Some of these assets might be available at each location, but more realistically, each location would require construction or modification of some sort. It is safe to assume that some of the locations could be readied within a year, and in the worst-case scenario, a site could require a major military construction project consuming up to 5 years. For the sealift option, AFLMA, working with MSC, determined that building a single ship to handle WRM shortfall

	% Afloat	% Airlift
Without 7 Days of Strategic Warning	45	53
With 7 Days of Strategic Warning	63	69
With Warning and Using Rail	100	69

Table 1. Percentage of RDD Met with and without Strategic Warning[23]

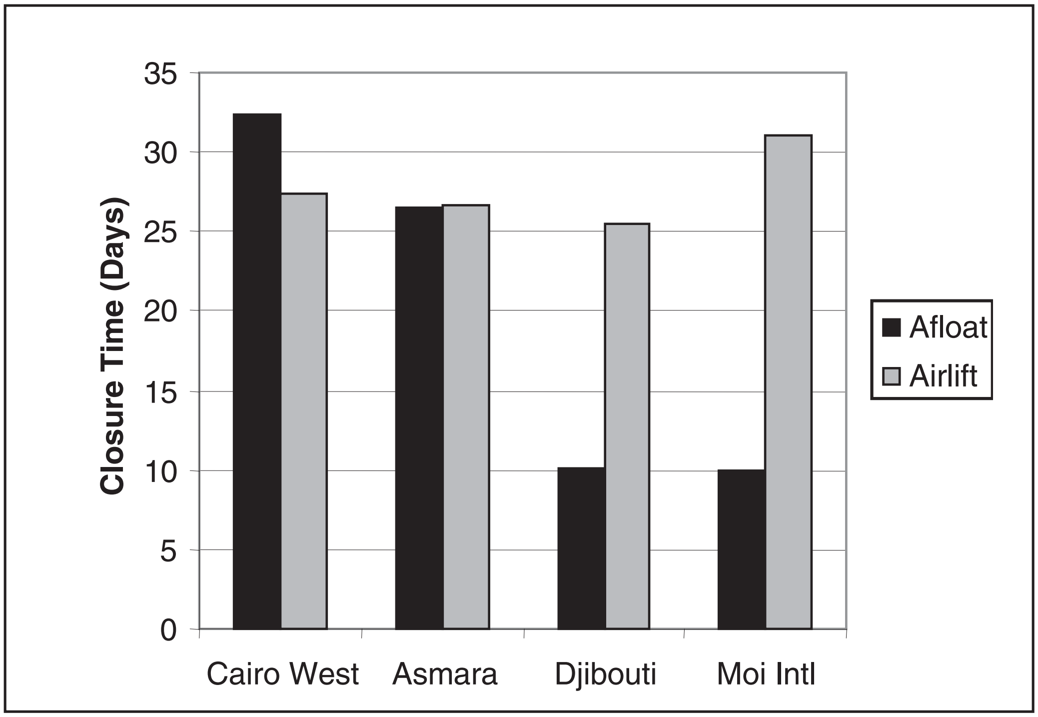


Figure 4. Closure Times—Southern Region of AOR

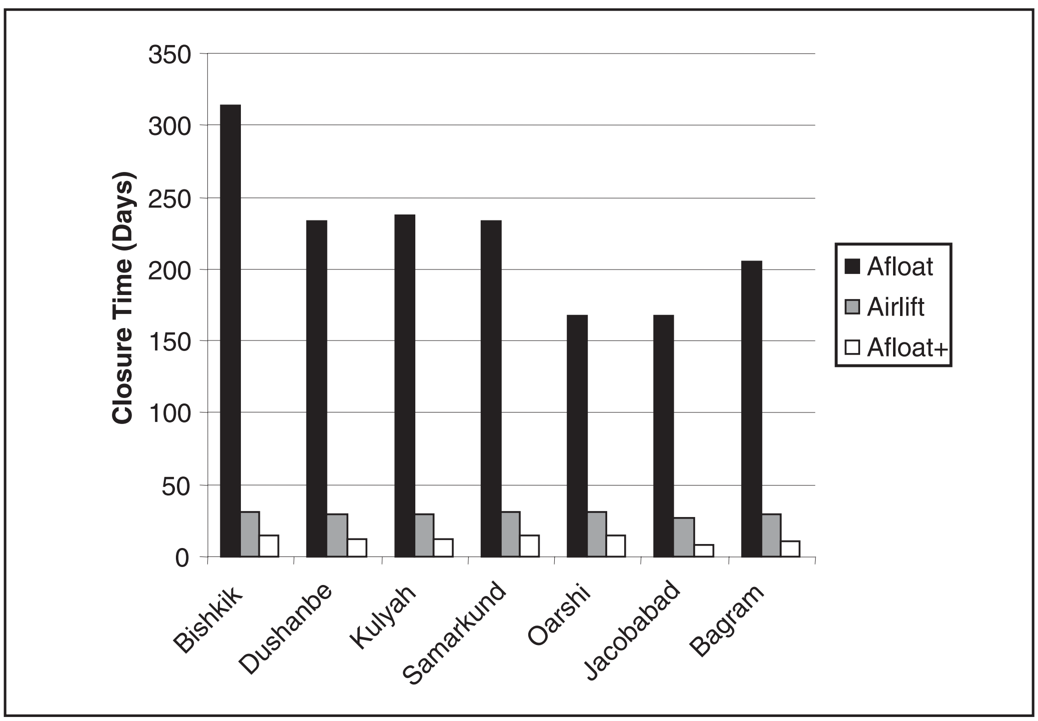


Figure 5. Closure Times—Northern Region of AOR

Type of Set	Requirement	Ready	Ready Rate
Housekeeping	87	52	60%
Industrial	15	4	27%
Flight line	40	12	30%

Table 2. Status of Bare-Base Harvest Equipment[30]

	1997	1998	1999	2000
Number of WRM Requests	110	177	115	114
Number Approved	105	167	106	102
Percentage Approved	95%	94%	92%	89%

Table 3. Air Combat Command WRM requests[34]

Year of Cycle	Afloat Costs	Land-Based Costs	Cost/Savings
1	$83,006,696	$89,617,435	-$6,610,740
2	$8,971,193	$796,044	$8,175,149
3	$96,917,316	$90,449,379	$6,467,936
4	$21,844,979	$1,592,089	$20,252,890
5	$26,441,050	$1,592,089	$24,852,961

Table 4. Cost Comparison for Two-Ship Program Versus Two Warehouses[38]

Year of Cycle	Afloat Costs	Land-Based Costs	Cost/Savings
1	$85,698,890	$89,617,435	-$3,918,545
2	$28,673,890	$796,044	$27,877,846
3	$97,804,578	$90,449,379	$7,355,199
4	$27,804,578	$1,592,089	$26,212,489
5	$25,950,000	$1,592,089	$24,357,911

Table 5. Updated Cost Comparison Using Summary Data from April 2003 Report

requirements would take about 2 years. However, if the Air Force were willing to split the cargo in half to fit on two smaller ships, then several ships would be available for lease on the market at that time.[28] AFLMA recommended that if a second ship is added it would be prudent to stagger the lease of the second ship to avoid having both ships (and their cargo) require maintenance at the same time. In addition to the ready availability of the ships, the Marines at Blount Island Command (BIC) in Jacksonville, Florida, were receptive to sharing their maintenance facilities with the Air Force.[29] These Marines perform the maintenance on the maritime prepositioning ships. Outside of the infrastructure required for each plan, personnel would be needed to run the maintenance. The centralized nature of the afloat maintenance would make hiring a maintenance contractor quicker for the afloat option. In light of all these factors, the afloat option seems to be quicker to implement.

The last area to be evaluated under responsiveness deals with the ability of each option to counteract antiaccess strategies by potential adversaries. Redundancy is one way to counter antiaccess by forcing an adversary to attack a variety of targets simultaneously. The FSL concept offers the most redundancy, with five geographically separated locations from which to move assets. The disadvantage of the FSL concept is that the locations are static and, therefore, lend themselves to more robust intelligence gathering by an adversary. Also, coalition partners can, over time, begin to perceive the assets stored on their soil as theirs. This issue was highlighted during Operations Northern and Southern Watch as the Turks and Saudis repeatedly tried to exercise control over US assets in their countries. The afloat option offers less redundancy, but the relative mobility of the ships offers the greater flexibility in terms of employment. In an extreme case, the ships could anchor at a secure port and offload the items for airlift to the needed location.

Readiness

Which option provides the best solution for meeting the readiness needs of the bare-base program? As previously discussed, components of this measurement include the amount of maintenance support needed for each option and how successful the maintenance program would be in terms of access to skilled technicians, spare parts, and the impact of environmental factors on the items. Readiness also considers how visible and measurable the assets would be under each option. These two factors center on the need for any ACS system to know where equipment is and whether or not it is ready to go. Several reports and studies have been done on the readiness of the bare-base and WRM program. The purpose of this article is to evaluate which concept affords the best opportunity at having a ready program, not to review specific issues of readiness. In 2001, the Harvest kits had readiness rates as shown in Table 2.

The primary reason that bare-base assets fall to low readiness levels is the constant demand for those assets. Even though the WRM program was developed technically for MTW scenarios only, the assets are, in fact, used much more frequently. A General Accounting Office (GAO) audit in 1998 found:

> Since the Gulf War, items have been taken from the bare-base sets to support a large number of contingencies and exercises. In 1992, bare-base equipment was used to support two operations—Joint Endeavor in Bosnia and Provide Comfort in Iraq. In 1996, it was used to support 22 exercises and contingencies, ranging from the Dhahran bombing to Operation Desert Strike. Certain key items, such as tents, generators, and air-conditioners, have been used the most and replaced most frequently. For example, between January 1996 and April 1998, more than 3,000 tents and nearly 4,500 air-conditioning units—about the number required for 27 and 30 complete housekeeping sets, respectively—were deployed from storage locations in Oman and Bahrain to locations throughout the theater. Equipment from these operations has often been returned in poor condition and has required significant repairs, according to program managers. The contractor conducting reconstitution of Air Force equipment in the Gulf region told us that efforts to reconstitute assets and move them into storage to meet prepositioning objectives have been frustrated by the Air Force's continuing heavy use of these assets.[31]

Conversely, the GAO's review of the equipment prepositioned by the Army and Marine Corps on ships was found to be significantly more ready. The GAO commented on the Marines:

> The Maritime Prepositioning Force—operational since 1984—has been given high marks for management by service auditors. In December 1996, the DoD Inspector General reported that Marine Corps systems provide reliable inventory data and that equipment afloat is maintained at high readiness levels. In April 1998, the Marine Corps reported that inventory fill and mission-capability rates were near 100 percent.[32]

And while the same 1998 GAO audit did find problems with Army afloat assets, those problems stemmed from the fact that the items had either never been purchased in the first place or shipboard maintenance was significantly behind in readying the onboard assets because of manpower or space limitations.[33]

What is apparent from these results is that land-based WRM assets lend themselves to more frequent use than ship-based assets. Would bare-base assets in an afloat prepositioned environment be more ready? Would the expense of docking the ship, contracting an offload, and using sailing fuel act as a constraint? Logically, the answer to these questions is yes. WRM requests for bare-base assets and their approval continue year after year. Table 3 depicts that data.

In addition to the fact that ship-based assets may be subject to less mission creep, other advantages for this mode of storage include a captive crew to maintain the bare-base assets while underway and a centralized, dedicated robust crew to perform heavier maintenance on the bare-base items while the ship undergoes hull certifications (normally every 30 months). The Air Staff uses the term *inviolate set* to fence off bare-base assets from the steady stream of use.[35] It may be that these sets would be most *inviolate* aboard a ship.

Using the forward support locations does have advantages in supporting readiness. First, FSL maintenance areas will not be space constrained the way a ship-based maintenance area would be. Second, getting spare parts to a land-based site should be easier compared to getting parts to a ship at sea. Additionally, forward support locations provide a maintenance capability (mainly space and infrastructure) that could be converted to centralized repair facilities (or even temporary billeting[36]) once the bare-base assets are deployed.

The primary reason that bare-base assets fall to low readiness levels is the constant demand for those assets, even though the WRM program was technically developed for MTW-scenarios only.

Supportability

As previously discussed, supportability measures the ability to sustain an option over time. The first area for discussion is congressional funding. While the FSL option does have three US locations (Alaska, Guam, and Puerto Rico), the other two forward support locations (Diego Garcia and Great Britain) are located in foreign territories. Comparatively, the afloat option would use US-flagged ships, and the maintenance (following AFLMA's recommendation) would most likely be performed at BIC in Jacksonville. Congressional support for the afloat option is likely to be stronger because of the predominance of US assets.

The next area for consideration is service and DoD support. The forward support locations most likely would be aligned with specific combatant commanders. This alignment with AOR-specific OPLANs would provide solid support during the budget process and allow both combatant commanders and the Air Force to weigh in on funding issues. The afloat option would be multi-AOR committed, which could either strengthen support from multiple combatant commanders or put the program in a *seam* with a support void. The best chance for success for an afloat option would be to designate an afloat asset as AOR specific, similar to the current concept used for Air Force munitions prepositioned on ships.

Force protection is also a consideration for supportability. No military mission can exist in the present environment without considerations for force protection. Many of our expeditionary sites have local hotels or facilities that could be used, but current planners will not even consider those assets because of force protection concerns.[37] Land-based locations can be protected but offer a static target for adversaries to plan against. Ship-based assets are much harder to interdict while underway and, like forward support locations, offer the flexibility of choosing from multiple ports for entry into the AOR. Port operations do present a force protection challenge, but their requirements are temporary in nature (unlike the constant protection needed for a land-based location).

Cost

Costs involved in each option will be assessed for both peacetime and wartime. Fixed and variable cost components will be identified for each option. AFLMA has done an excellent job in providing a cost analysis of afloat versus land-based storage. For peacetime, it found that the afloat option would be more expensive than adding two additional warehouses to the land-based WRM structure (Table 4).

Several caveats need to be made to the results from the October 2001 study. One, the first and third year costs for both programs included $70M in fixed costs to fund the shortages in the bare-base program. Two, AFLMA's land-based model only included two warehouses added to a CONUS-based site. Therefore, estimating the costs for outfitting five forward support locations requires some extrapolation. Not every forward support location would need additional warehouses since some WRM storage already occurs at each of the sites.[39] But the costs for additional warehouses would probably be equal to, if not more than, the land-based model used by AFLMA. Finally, the afloat costs were reworked in a subsequent AFLMA study (released in 2003), which was developed much more and resulted in increased costs to the afloat option. The summary based on the new costs is shown in Table 5 and still includes the fixed cost of $70M in the first and third year to fund shortages in the bare-base program.

In looking at the wartime costs of land versus afloat, AFLMA conducted extensive analysis. Its finding was that:

> …during wartime the ship quickly paid for itself. Three hypothetical excursions were run involving conflicts in Southwest Asia, the Pacific Air Forces, and Air ForceE with afloat prepositioning resulting in savings of $7.3M, $12.1M, and $6.7M, respectively, over land-based prepositioning.[40]

Criteria	AFLMA Proposal Two Preposition Afloat Ships	RAND Proposal Five FSLs
Responsiveness		
Implementation timing	Immediate for first ship. Second ship staggered for logistics reasons to allow use of a central repair facility.	Immediate to 5 years. All but one of the proposed FSLs already has Air Force operations. However, additional infrastructure would be required to make all five locations fully mission capable.
Force closure capability	Equals FSL option with 7 days of strategic warning. Slower than FSL option when inland transportation is limited.	Faster if airlift is primary mode. Yet, Iraqi Freedom highlighted that, during MTW, airlift would most likely not be available. Slower when intratheater sealift is used or when afloat option has access to inland rail transportation.
Ability to counter antiaccess issues	Successful because of flexibility of ship positioning.	Successful because of redundancy of locations and collocation with coalition partners.
Global responsiveness	Yes (majority of the world's population lives within 650 nautical miles of a coastline).*	Yes (FSLs put most of world within 3,000 nautical miles of an FSL).
Secondary transportation requirements	Best case: three legs. Worst case: five legs.	Best case: four legs. Worst case: six legs.
Readiness		
Visibility and access	Static in nature. Lends to less use for other missions and more accurate visibility.	Dynamic in nature. Historically has resulted in the release of assets for other uses.
Maintenance support	Centralized on board ship and at port maintenance facility during hull recertification.	Decentralized at each FSL.
Supportability		
Congressional support	More apt than FSLs to be congressionally supported because all components of program are US assets.	Three of five FSLs identified are US territories. The other two are British. Would probably receive strong support.
Combatant commander	Possibly less support from combatant commanders if assets are not MTW dedicated.	Stronger since assets are MTW dedicated and in the AOR. Also, FSLs double as centralized repair facilities for the combatant commander.
Force protection	Easier because of maneuverability at sea. Requires temporary force protection measures for port operations.	Harder because of the static nature of locations. Requires constant force protection measures.
Coalition	Not coalition engaging.	Coalition engaging but may lead to perception of host-country ownership.
Cost		
Peacetime costs	More expensive.	Less expensive.
Wartime costs	Less expensive.	More expensive.

*Dr Scott Bowden, Forward Presence, Power Projection, and the Navy's Littoral Strategy: Foundations, Problems, Prospects, IRIS independent research, 1997 [Online] Available: http://www.irisresearch.com/littorals.htm.

Table 6. Summary of Analysis

Once again, these numbers are not specifically conclusive to the emphasis of this article because of some limitations. One, AFLMA based the land-based costs on airlifting all assets from Holloman AFB, New Mexico. Two, only a single ship was used in the cost analysis. Based on the force closure estimates used in the April 2003 AFLMA study, it would seem that the cost of transporting land-based assets would be less because of the probable use of intratheater sealift versus airlift.

The research done by AFLMA is thorough enough to offer two conclusions concerning costs. One, the peacetime cost of using a ship will be more than storing the same assets in a land-based warehouse. Two, having the assets on a ship when an execution order comes reduces the transportation cost of moving the same assets from a land-based warehouse. The one caveat to that would be if the assets were collocated at the actual fighting location. However, the five forward support locations recommended by RAND are not bare-base locations that would require these assets.

Summarizing the Analysis

The previous discussion of each criteria and the relative strengths and weaknesses of each option are summarized in Table 6.

Conclusions and Recommendations

Teamwork allows us to be an effective fighting force—a rapid expeditionary force capable of deploying anywhere in the world in a minimum of time and in austere conditions—not operating from where we are stationed, but from where we are needed, not when we can, but when we must.

—General Michael Ryan, USAF

Successful expeditionary operations require a bare-base capability with an ACS system that can get them to a contingency location rapidly. A successful bare-base strategy must be responsive, ready, supportable, and achievable with respect to

cost. The Air Force has struggled with meeting the vision of its Chief of Staff in terms of establishing and sustaining rapid bare-base operations. The two study agencies have attempted to provide solutions to this problem. AFLMA looked at the cost and risks to OPLAN execution of adding an afloat prepositioned capability, and RAND looked at basing strategies. While the RAND study was not specifically developed to look at the storage and maintenance of bare-base assets, its proposal to incorporate five forward support locations as part of a global Air Force basing infrastructure provided a potential for using these locations as a substitute for an afloat option. AFLMA conducted extensive cost and risk analysis comparing a ship-based concept against a land-based storage location. In the AFLMA study, the storage location used for analysis was not one of RAND's proposed forward support locations. However, the costs and risks measured in the study should have been more favorable toward an FSL concept since the land-based location used by AFLMA was closer to the conflict location than any of the five forward support locations. Yet, in measures of cost and risk, the afloat option proved to be competitive with the land-based option. In addition to the cost and risk measures evaluated by AFLMA, this article also tried to quantify a number of additional issues related to responsiveness, readiness, and supportability.

In the end, neither option stands out as the unequivocal choice for the Air Force to store and maintain bare-base assets. Senior leaders to whom cost is a primary issue, most likely, would choose the land-basing strategy. Senior leaders concerned with readiness, most likely, would see the afloat option as the answer. This article advocates that an afloat option has sufficient merit across the spectrum of readiness, responsiveness, supportability, and cost to make it the better choice over the land-basing strategy. However, to strengthen the afloat option's ability to enable the Air Force to project expeditionary forces in a global environment, several recommendations can be made.

Recommendations

First, it is important to lease two readily available ships rather than delay for the construction of a specialized ship. It may mean temporarily leasing a less-than-optimum vessel while waiting for a better match to become available on the market. It is also important to stagger the leasing (as recommended by AFLMA). This avoids the proverbial *eggs in one basket* and allows for a single port to be used for maintenance (because of the staggered nature of the hull certifications).

Second, it is important to blend into the existing operations of the Marines at Blount Island Command. The Marines have been evaluated most favorably by the DoD and GAO and, obviously, know how to maintain the ships and assets on the ships. One of the key strengths of the afloat option was the speed with which it could be implemented. That evaluation was based on the use of Blount Island facilities.

Third, even though Blount Island should be the primary maintenance location, it would be beneficial to set up overseas maintenance locations. Recommendations include Diego Garcia, Singapore, and Qatar. These locations offer opportunities for coalition building and practice with port operations for key regional access.

Fourth, the ships should be stocked first with the *inviolable* sets deemed critical by the Air Force. The constant use of bare-base assets for everything from humanitarian operations to small-scale contingencies has decimated the program. The Air Force is smart to recognize that a certain capability has to be deemed inviolable, because the current system has shown a reluctance to deny requests for non-MTW use of bare-base assets. The Marines and the Army have proven that ship-based WRM assets maintain a higher degree of readiness than land-based storage.

Fifth, the ships should be MTW dedicated. Combatant commander sponsorship can add issues with coordination during steaming and port operations, but it also provides a valuable ally in the fight for resources. Additionally, it allows for the assets to be evaluated in readiness metrics (that is, SORTS) to keep senior leaders focused on the program. Realistically, the strength of the afloat option is that it provides a global response, but the threats that drive the need for a bare-base capability are primarily regional, and the ships can be very easily tied to an MTW scenario.

Sixth, AFLMA's April 2003 study proposed sourcing WRM assets for the preposition ships from currently assigned CENTCOM assets. That initiative should go beyond CENTCOM and include worldwide WRM assets. This recommendation stems from two facts. One, the afloat option makes the most sense with two ships, and it may not be possible to find enough CENTCOM assets to fill two ships. Two, since the ships should be aligned with a combatant command, it would make more sense to have one dedicated to Pacific Command and the other to CENTCOM.

Finally, the afloat option is not a panacea. Some land-based storage is prudent and necessary. Land basing with long-time coalition partners has advantages that go beyond the efficiencies of good logistics. As the Air Force begins to develop its *lily pad* strategy for Eastern Europe and other regions of instability, it may make sense to have limited bare-base storage in those areas.

Notes

1. *United States Air Force Posture Statement 2003*, 25 Feb 03, 10.
2. Air Force Doctrine Document 1, *Air Force Basic Doctrine*, 17 Nov 03, 88.
3. James R. Galluzzi, "The Bare-Base Program—History and Analysis," research study, Air Command and Staff College, Maxwell AFB, Alabama, May 74, 9.
4. The National Security Strategy of the United States of America, 17 Sep 02, 16.
5. *United States Air Force Posture Statement 2003*, 10.
6. *United States Air Force Posture Statement 2003,* 17.
7. Warm basing describes locations having a developed infrastructure to support air operations, as well as a variety of prepositioned assets. These bases were routinely used for deployments to help prepare forces for their eventual use in war.
8. Lionel A. Galway, et al, "Supporting the EAF: A Global Infrastructure," *Combat Support: Shaping Air Force Logistics for the 21st Century*, Aug 03, 32.
9. Robert S. Tripp, et al., "Supporting Aerospace Expeditionary Forces: Lessons from the Air War Over Afghanistan," RAND Draft report, 64.
10. Tripp, 65.
11. Galway, 32.
12. Galway, 32-33.
13. *Ibid*.
14. David A. Shlapak, et al, "Global Access: Basing and Access Options," Combat Support: Shaping Air Force Logistics for the 21st Century, Aug 03, 115.
15. Shlapak, 114.
16. Paul E. Boley II, "Cost-Benefit Analysis of Afloat Prepositioning of Nonmunitions War Reserve Materiel," Air Force Logistics Management Agency Report LX200001300, Oct 01, 1.

(Continued on page 47)

Special Feature

It's (transformation) happening today here, at Robins AFB [Georgia]. In the future, when other bases and other wings attempt to implement a Future Total Force initiative, those who follow will measure their success against the "Robins Model."[1]

**—Dr James Roche,
Secretary of the Air Force**

Introduction

Dr Roche spoke these words to the men and women of the 116th Bomb Wing and 93d Air Control Wing (ACW) to mark the end of their units as separate reserve and active organizations. The two wings integrated into the 116th Air Control Wing with a makeup consisting of both active and reserve members. This event was significant in that it was the latest in a series of attempts by the Air Force to merge elements of the active and reserve components. With a year of experience behind it, the Robins Model will be used as a roadmap to integrate other units.[1]

Early attempts at integration met with failure, resulting in nearly a decade's passing before any effort in this area was made again. The two components will successfully meet the vision of Future Total Force only through a strong long-term commitment throughout the Air Force and Air Reserve Component (ARC). This article looks at the compelling factors that led to initial integration efforts, why they failed, where we now stand, and what the future benefits and challenges will be.

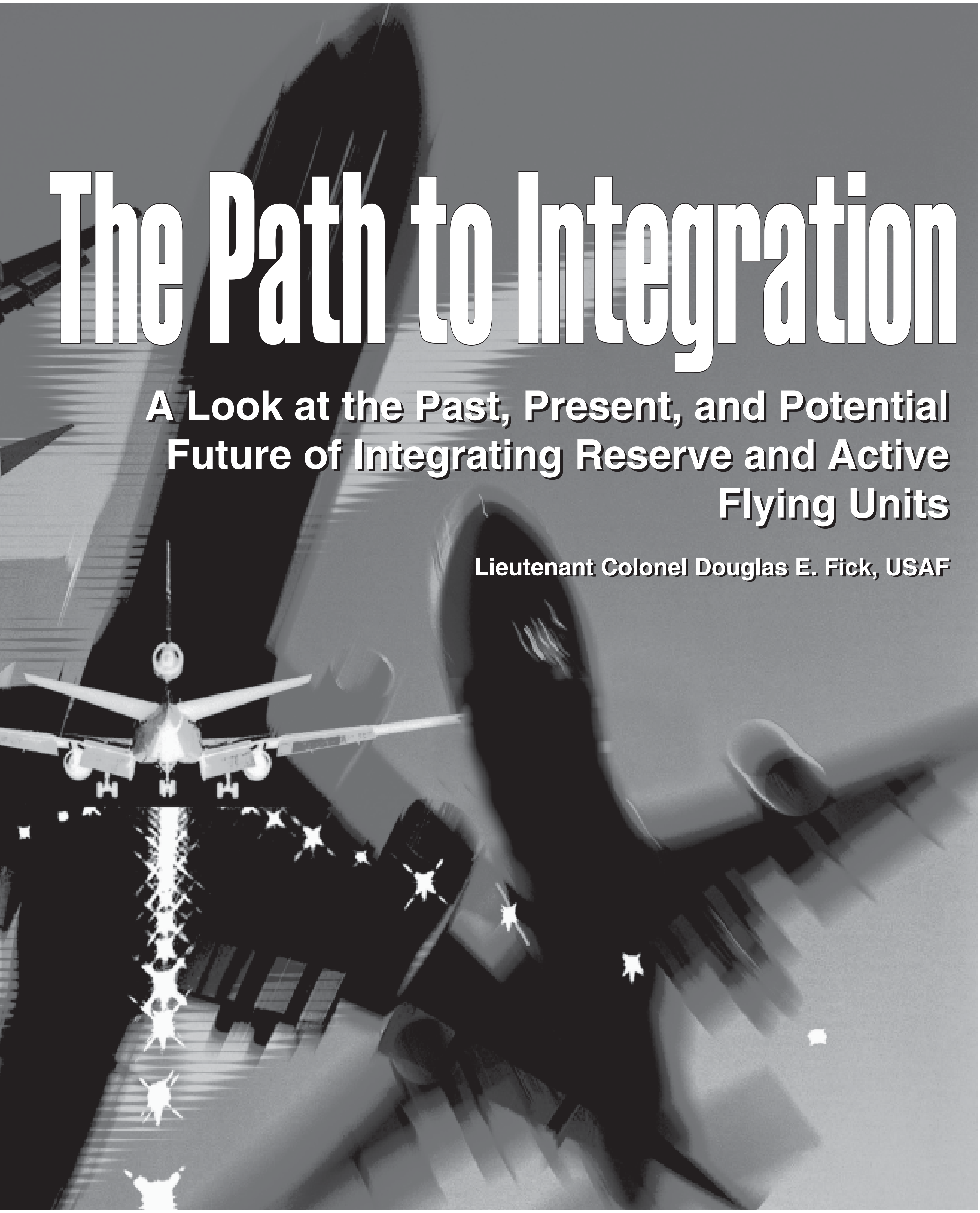
The Absorption Issue

Absorption of new pilots into the Air Force has been a challenge for rated officer assignment personnel and is perhaps the primary driving factor toward integrating active and ARC units. According to Air Force Instruction (AFI) 11-412, "Absorption is the number of inexperienced crewmembers who can be assigned to a major weapon system per year."[2] Before delving into the complexities of the absorption problem and why the ARC provides assistance toward resolution, it may be beneficial to use an analogy to get an initial concept of absorption. In one aspect, an operational active component squadron can be viewed much like a factory. It takes in raw material (new inexperienced pilots not yet experienced in the applicable aircraft) and produces a product (the same pilot now seasoned and fully mission capable in the aircraft). The Air Force then uses the seasoned pilots to continue the training process or fill staff positions where their flying knowledge is critical.

The Path to Integration

A Look at the Past, Present, and Potential Future of Integrating Reserve and Active Flying Units

Lieutenant Colonel Douglas E. Fick, USAF



Tools are required to perform this task. At its most basic, those tools are instructor pilots, other experienced pilots, and aircraft sorties. When the system is balanced, there is the right flow of new pilots to match the availability of instructors for initial training missions, the right mix of experienced pilots, and the capability to generate needed sorties. Problems arise when any one of the tools is insufficient.

Mismatches occur when there are too many inexperienced pilots or there are not enough instructors and experienced pilots. When this happens, inexperienced pilots do not have adequate access to tools to receive training on a consistent basis. This spreads out the process of seasoning, thus slowing the absorption of new pilots into the ranks of both experienced and instructor pilots. Compounding the problem even more is that flying is a perishable skill. Skill building must be done on a regular basis, or skills they had learned previously tend to erode. This further slows the Air Force's ability to season new pilots.

Causes of absorption mismatches are many and date back to the post-Vietnam era. In 1982, Master Sergeant Ed Martins, writing for the *Air Reservist*, wrote:

> It's called an absorption problem. The Air Force does not have enough cockpits to train properly all the pilots coming into its flying units. They come from pilot training, instructor duty, and mission support areas. Putting these pilots into a limited number of cockpits would drive the experience mix toward unacceptably low levels.[3]

the fact that the Air Force's force structure would be reduced and, therefore, focused on shaping the ultimate force levels. The Base Force also necessitated a reduction in active manpower for the Air Force to approximately 436,400 by fiscal year (FY) 1997 (a 20.3-percent decline compared with FY90 levels) and a reduction in reserve end strength to some 200,500 (a 21.6-percent decline).[6] The Air Force was willing to forego force structure to keep highly trained people and fund future capabilities. The planned net result is shown in Table 1.[7]

The actual reduction closely matched the above figures. Active tactical fighter wings went from 24 to 16.1, and reserve fighter wings dropped from 12 to 11.5.[8] It is likely this force would have been sufficient for future needs except for one unanticipated development—contingency operations. The RAND study, from which the data in Table 1 are pulled, states:

> One of the Base Force's key premises—that the post–Cold War world would not be occasioned by large-scale, long-duration contingency operations—was cast in doubt by the post–Gulf War stationing of Air Force tactical fighter and other aircraft in Southwest Asia: a commitment that, despite predictions to the contrary, would remain through the end of the decade.[9]

The decision to cut the force structure, along with increased deployments, resulted in the same units and pilots being tasked constantly with contingency operations, reducing *training*

During the 1990s, three separate review programs were implemented in an attempt to size the military for what was believed to be the level of threat for the start of the next century.

Pamela Kane, writing for the *National Guard Magazine* in 1981 stated:

> In the early 1980s, the problems were fueled by the fact that many experienced pilots opted for the airlines or the Air National Guard (ANG) and Air Force Reserve after the Vietnam conflict. Since the Vietnam drawdown, the need for active-duty pilots has diminished greatly. No war, no demand. Or so were the thoughts of the American public, which pressured Congress to limit military budgets. At the same time, the experienced pilots, like other well-trained servicemen, left the active Air Force and sought civilian pilot positions and the Air National Guard.[4]

The post-Vietnam era saw absorption challenges not only in experience loss but also in total number of sorties available. The situation did not improve in the 1990s.

With the dissolution of the Soviet Union, America's military force structure was addressed. It was believed the end of the Cold War would allow for a peace dividend, freeing up dollars by reducing military spending. During the 1990s, three separate review programs were implemented in an attempt to size the military for what was believed to be the level of threat for the start of the next century.

The first program of the 1990s ran from 1990 until 1993; this review process was called Base Force.[5] The Air Force's principal aim throughout the Base Force initiative was to preserve its modernization and acquisition programs. Accordingly, early in the process of defining the Base Force, Air Force leaders accepted *opportunities* and negatively impacting quality of life. The absorption equation did not improve in the mid-1990s with implementation of the Bottom-up Review (BUR).

Service and Major Forces	FY90	FY97	Change
Army			
Army divisions	28	20	-8
Active	18	12	-6
Reserve	10	8	-2
Navy			
Aircraft carriers	15	12	-3
Active	13	11	-2
Reserve	2	1	-1
Battle force ships	546	451	95
Air Force			
Tactical fighter wings	36	26	-10
Active	24	15	-9
Reserve	12	11	-1
Strategic bombers	268	180	-88
Manpower (thousands)			
Active military	2,070	1,626	-444
Reserve military	1,128	920	-208
Civilian	1,073	904	-169
Total	4,271	3,450	-821

Table 1. Planned Base Force Changes to Force Structure and Manpower FY90-97

The BUR was conducted in 1993 with the intent of accelerating and surpassing the force structure reductions planned under Base Force, increasing the total reduction from 25 percent to 33 percent. Additionally, "The BUR redefined the meaning of engagement in an important way, giving increased rhetorical and policy importance to US participation in multilateral peace and humanitarian operations while setting the stage for an increased operational tempo and rate of deployment even as force reductions continued.[10] Once again, the incompatible goals of increased operational tempo and force reduction would continue stresses initiated by the Base Force draw down. Political decisions to keep a strong overseas presence saw slightly more than 40 percent of Air Force tactical fighter wings deployed outside the continental United States. The Navy successfully argued that deploying more than 25 percent of its carriers was not sustainable while maintaining adequate readiness levels and, thus, kept a relatively higher number of operational flying units than the Air Force. The Air Force did not press the case that, as with the Navy carriers, overseas presence needs and support to contingencies should be considered in determining the number of tactical fighter wings in the force structure.[11] If such an argument had been made successfully, the resulting increases in force structure would have eased the strain of limited time to train and reduced personnel tempo. Given the fiscal constraints of a hard top line of $250B for defense during the period, it is in doubt as to whether the argument would have fallen on willing ears.

The 1997 Quadrennial Defense Review (QDR) was the third and final attempt in the decade to bring strategy, forces, and resources into alignment. In many ways, the QDR and BUR were similar in limitations and objectives. The QDR was faced with the same top-line defense budget of $250B; competing for these dollars were ongoing modernization efforts, continuing heavy deployment schedules and eroding force readiness issues.[12] Additionally, while the BUR strategy was one of engagement and enlargement, the QDR strategy elements of shaping and responding had the same practical effect on Air Force units: they relied heavily on forward presence and crisis response capabilities. Both were concerned with ensuring near-term stability in regions of vital interest. The largest ongoing Air Force commitments, the ones causing greatest turbulence, continued to be associated with US operations in Southwest Asia and the Balkans.[13]

The QDR continued the trend toward end-strength reductions, but to a much lesser extent than either Base Force or BUR.

While Table 2 shows the Air Force drawing down from 372,000 toward a QDR goal of 339,000, most of the downsizing was from

	1988 Estimate	1999 Projection	2003 Projection	QDR Goal
Army	488	480	480	480
Navy	387	373	369	369
USMC	173	172	172	172
Air Force	372	371	344	339
Total active	1,420	1,396	1,365	1,360
Selected reserves	886	877	837	835
Total civilians	770	747	672	640

Table 2. Planned Department of Defense Personnel End-Strength Levels FY98-03 (in Thousands)

Article Highlights

The history of attempts at integrating active Air Force and reserve component units is checkered at best. All units met with failure, resulting in nearly a decade's passing before any effort in this area was made again. Recently, with Future Total Force, as a backdrop, the 116th Bomb Wing and 93d Air Control Wing integrated into the 116th Air Control Wing with a makeup consisting of both active and reserve members. This event was significant in that it was the latest in a series of attempts by the Air Force to bring elements of the active and reserve components together. With a year of experience behind it, the Robins Model will be used as a roadmap for the integration of other units.

This article looks at the compelling factors that led to initial integration efforts, why they failed, where the Air Force now stands and what the future benefits and challenges will be. Of note in the article are the latter sections where the major impediments to integration are examined and discussed. While not a purely logistics article, the issues outline herein will have a major impact on both operations and logistics elements.

aggressive, competitive outsourcing (25,400).[14] While manpower reductions were modest during the QDR, the real impact continued to be operational tempo and readiness issues.

By February 1998, the Chairman of the Joint Chiefs of Staff, General Henry Shelton, in testimony before the Senate Armed Services Committee, described an emerging picture of readiness problems driven by a high operational tempo and wrote, "There is no question that more frequent deployments affect readiness. We are beginning to see anecdotal evidence of readiness issues in some units, particularly at the tactical level of operations. At the operational and strategic levels, however, we remain capable of conducting operations across the spectrum of conflict."[15] Within the Air Force, the impact is best summarized by the following 5 May 1998 background briefing on military readiness:

> As we go into '99, our concerns that continue with us in the Air Force are the tempo—we're at a very high tempo. The Air Force transition[ed] from a Cold War force of fairly good size, equivalent to about 36 fighter wings. We've reduced our force structure and completed that by about a third. We reduced our overseas force structure by about two-thirds. At the same time, our contingency-tasking operations have increased by a factor of four. That drives tempo. [T]he aging aircraft that I mentioned. We're concerned about that, as it continues on because of [the] need to replace not only parts, but also engines and other expensive items to keep that fleet going as we move into our modernization period. We're right now forecasting about an 1,800 pilot shortfall by '02. That's from a baseline of about 14,200 on our requirement. . . . I would like to be able to say [that it's as bad as it's going to get on retention of pilots and other [personnel], but I don't think we're going to get better.[16]

The net result of the 1990's strategy and budget decisions is that since FY97 the loss rate for pilots reaching the end of their initial active-duty service commitment has averaged close to 70 percent, the highest rate ever, except in periods of demobilization or drawdown. Also unprecedented is the loss rate for pilots who have reached their 15th year of service but are not yet eligible for retirement.[17] The combined effect since FY97 is three pilots have left active duty for every two new pilots that the Air Force has trained.[18] Pilots in these brackets are the experienced core of an operational unit; such an experience drain drastically slows the ability to season inexperienced pilots entering the unit. One solution the Air Force adopted was increasing the active-duty service commitment from 8 to 10 years starting in FY97, but the net effect will not take effect until 2007. The upward trend after 2007 is based solely on the Air Force's assessment that the 10-year commitment will have a positive impact on retention since those pilots will have from 11 to 13 years of total service before being eligible for separation. This would put retirement benefits only 7 or 8 years in the future for these pilots, making them more likely to finish a 20-year career to realize the benefits (Figure 1).

There are two major areas of concern that the pilot shortage causes. The first is the absorption equation; not enough experienced pilots are staying in to train the next generation of aviators. The second area of concern in filling key staff positions. With so few qualified pilots to draw from, the Air Force must decide either to leave experienced pilots in the squadron to help train or have them fill critical staff billets where their expertise is needed—it cannot do both.[20] Because the absorption equation folds back on itself—production of experienced pilots becomes the tool for the next generation of training; the longer the lack of experienced pilots exists, the worse the situation becomes. As the RAND study states, it becomes a slippery slope with ever-decreasing experience levels in operational squadrons.[21] Currently, the production rate is 330 pilots per year. This rate likely will take operational units into training circumstances where large numbers of assigned mission pilots are decertified from combat-ready status, pilots average too few sorties per month, and the training available to inexperienced pilots is inadequate. To support the current and future needs of the Air Force, total training output must increase to 382 pilots per year.[22] The Air Force has several other options to reverse this downward trend.

First, the Air Force could try to increase the number of sorties flown by operational units. More sorties would increase the training capacity of operational units, allowing more opportunities for inexperienced pilots to get consistent training. Training capacity is a function of two elements, the number of aircraft a unit has (primary aircraft authorization [PAA]) and how often each aircraft can be flown over a given period (utilization [UTE] rate). Increasing the PAA is prohibitively expensive; any aircraft purchased would compete directly for dollars with modernization efforts (such as the F-22 and F-35). Increasing UTE rates also poses problems. These issues include funding additional flying hours, maintenance manning to support the extra flights, parts supply

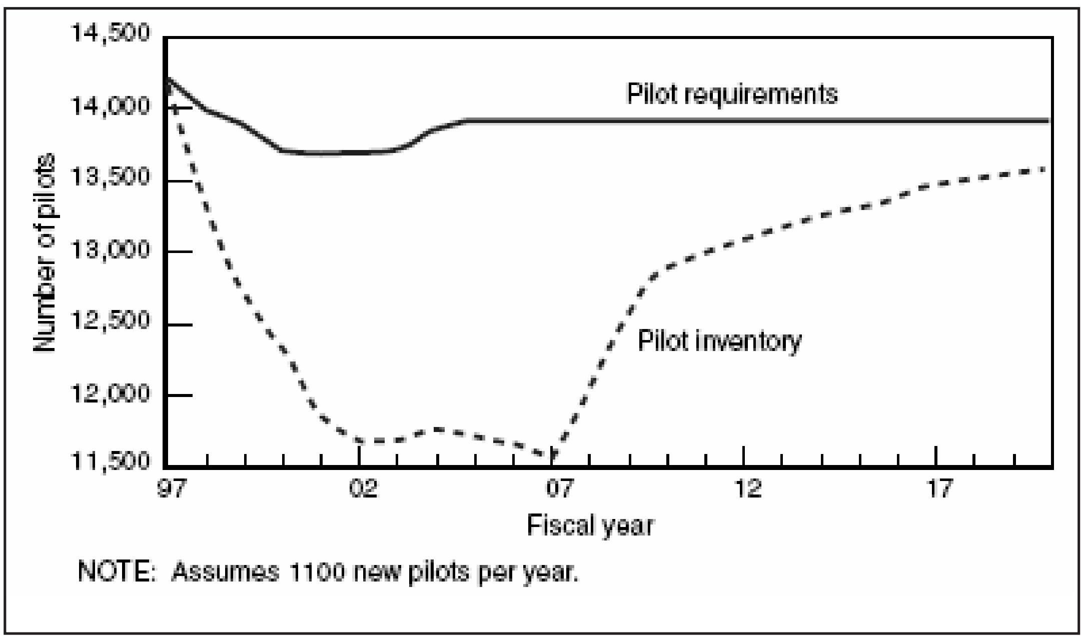


Figure 1. Pilot Requirements versus Pilot Inventory[19]

problems, and aircraft age.[23] Additionally, without increasing the number of experienced pilots, the additional sorties would force the current pilots to fly more often. The ability to fly experienced pilots on extra sorties per month is limited by available flying days and required duties outside of flying, further limiting the utility of increasing the UTE rate.

The next option to balance the absorption equation is to decrease the number of incoming new pilots. While this will bring an operational squadron back into balance (training tools are equal to training requirements), it ignores the long-term pilot needs of the Air Force and is not sustainable for any extended period.[24]

Third, the Air Force is looking to increase retention rates of experienced pilots. The Air Force will need to overcome factors such as the large pay disparity between military and commercial flying, the negative effects of multiple deployments, frequent moves, family turmoil, and other quality-of-life issues.[25] With the current downturn in airline hiring, caused by the economic slowdown after 11 September 2001, there is a temporary lull in job opportunities in the civilian sector. This will provide temporary attrition relief, but long-term market effects likely will return to pre-9/11 conditions.[26] Success in this area would have the greatest impact on absorption and overall pilot manning in the Air Force, but historically, finding a strategy for success has been elusive, as low pilot bonus take rates during the late 1990s have shown.

The last option is total force absorption. Unlike active component operational squadrons, which only bring in inexperienced pilots, reserve component squadrons have two sources for reaching pilot manning levels: inexperienced pilot applicants sent to pilot training by the reserve unit and recruiting experienced pilots from the active duty. Active component squadrons strive for a 65-percent experience level (a level last encountered in 1996)[27] but typically see rates in the 50-percent range. ARC squadrons quite often see 90 percent of their squadron experienced. For our absorption equation, a squadron with a 90-percent experience rate has the ability to absorb and train inexperienced pilots as long as the sorties are there to support the effort. This fact was not lost on the Air Force, and in 1981, the Air Force, Air Force Reserves, and ANG entered a program called Project Season.

Project Season

During the peak of the Vietnam conflict, Air Training Command was producing more than 3,000 pilots annually. In the post-Vietnam era, that number dropped dramatically; by 1978, less than 1,000 pilots were being trained each year. As the 1980s began, a serious pilot shortage had developed. The Air Force responded by increasing pilot production to 1,900 by 1981. This surge of inexperienced pilots into an active component operational squadron had the net effect of dropping experience rates to between 30 percent and 70 percent. With such low experience rates, the new pilots could not be absorbed into the system. More cockpits and experienced mentors were needed, and the Air Force looked to the ARC for help.[28]

The ARC had two factors that made this a winning situation for both active duty and reserve. First, at the same time that the Air Force was looking to place inexperienced aviators with the ANG and the Air Force Reserve Command for seasoning, ARC was experiencing vacancies in pilot manning. The traditional source of manning for these units was from the pool of prior service pilots; by the early 1980s, this pool had dwindled because of years of low Air Force output. While ARC units were allowed to send a limited number of selected applicants through the Air Force training program, there were few slots available. Additionally, the long training cycle, from initial selection until completion of basic pilot training (typically 2 years or more), meant the flow would not be adequate to keep up with attrition (retirements and separations). Second, the experience rates in the ARC remained very high, allowing them to absorb inexperienced Air Force aviators without seriously impacting unit experience levels.[29]

Out of these complementary goals, Project Season was developed as a 7-year training cycle, running from 1981 through 1987. Beginning in FY81, active-duty inexperienced pilots started seasoning with ARC units, and eventually, approximately 200 pilots would fly with the Guard. The program ran through FY87 when the last of these pilots returned to active-duty units, and the ARC-selected applicants (now qualified as inexperienced pilots) returned to the ARC unit to replace the active-duty pilots.[30]

Project Season was developed as a 7-year training cycle, running from 1981 through 1987. Beginning in FY81, active-duty inexperienced pilots started seasoning with ARC units.

Despite the initial win-win perception of Project Season, several factors quickly soured the program. During this timeframe, Lieutenant General Jon B. Conaway, USAF, Retired, was chief of the National Guard Bureau and director of the ANG. He made several observations regarding Project Season. The first was that the program came with no flying hours or maintenance support for the additional sorties required to train the inexperienced aviators. Additional training sorties were not a factor in units that were undermanned; excess sortie capacity existed in these situations. However, not all units that took Air Force inexperienced pilots were undermanned. They either had to reallocate sorties among the pilots or ask the National Guard Bureau for more flying hours. They then had to task their maintenance organizations to generate more sorties to meet the increased demand (without additional maintenance manpower from the Air Force to support flying the inexperienced Air Force pilots).

In addition, the Air Force charged any mishaps caused by Project Season active-duty pilots against the ARC with which they were flying. Comparisons between the mishap rates of the various Air Force components often are used as a yardstick of the level of professionalism and training within the component. With a much smaller total flying-hour pool, being charged with even one or two additional mishaps could have political consequences because of an elevated mishap rate. Conaway did not view either of these issues as showstoppers; the components dealt with them on a case-by-case basis.[31] The critical factor came about when it was time for the Project Season pilots to return to the Air Force. Dr William W. Taylor of the RAND organization made the following observation:

> A primary difficulty with the previous Project Season initiative was the result of the short (5- or 6-year) active-duty service commitment that the participating pilots incurred. When coupled with a liberal Palace Chase policy that was also in effect at the time, this made most of the pilots eligible to affiliate with the Guard or Reserve when they finished their initial operational flying tour. The young pilots who favorably impressed their Guard (or Reserve) unit leaders were heavily recruited to leave active duty and remain in the same unit. Conversely, the participating pilots who did not perform well during this initial operational tour were certain to return to an active unit because their Guard or Reserve unit was unwilling to keep them (even if they wanted to affiliate and were eligible to do so). This situation could have generated a negative performance bias in the group who stayed on active duty—a disproportionate share of them failed to distinguish themselves during their initial operational tour, whereas pilots who performed well were likely to respond to encouragement and separate from active duty.[32]

There were several reasons why the Project Season pilots left active duty in such high numbers. First, ARC offered lower deployment rates plus the ability to homestead in one location. A typical active-duty fighter pilot career would consist of permanent changes of station once every 2 to 3 years and at least one remote unaccompanied tour. For many families, the ability to live a more stable life without multiple moves and extended separation was very attractive. Second, the major airlines started a large hiring spurt during the 1980s. Many Project Season pilots seized the opportunity to separate from the Air Force, gain a commercial pilot job, and then use part-time employment in the ARC as an income supplement during their initial, low-paying years with the airline. A program that started out with much promise ended up with the unofficial moniker of Project Treason.[33] The failure occurred partly because of bad timing but more so because the Air Force failed to understand the economic and lifestyle dynamics that came into play. Because of the failure of Project Season, it would be more than a decade before the Air Force would attempt another integration effort with the ARC.

Total Force Absorption Program

In 1999, 12 years after the failed Project Season program closed, the four-star Rated Summit (RS 99) again addressed the absorption issue. The Total Force Absorption Program (TFAP) initiative had (and continues to have) the ARC absorbing 50 active-duty pilots per year with 30 of them going to fighter units. Two key factors had changed that allowed the Air Force to make another attempt: 10-year commitments and the end of the Palace Chase program. The 10-year service commitment introduced in 1997, along with limiting when TFAP pilots are allowed to fly with the ARC, ensures these pilots have at least 3 years of service commitment to the Air Force prior to separation eligibility. By the time of separation eligibility, these pilots typically will have between 12 and 13 years of total time accumulated toward retirement. The Air Force views this as a strong incentive to remain with the active-duty Air Force since separating to the ARC most often means delaying retirement benefits until age 60.[34] Another key provision was to provide a TFAP concept for oversight, to include a mechanism that ensures participants are linked to active-duty units throughout their assignments with the ARC.[35] Although not explicitly stated, this linkage provision was likely the result of lessons learned from Project Season; lack of oversight during Project Season was blamed, in part, for the high number of pilots that left active duty for the ARC. Lack of mentoring about active-duty advantages and career opportunities, combined with easy separation options, were, at least partially, responsible for the Project Treason syndrome.

The Fighter Associate Program continues the concept of greater integration between the Air Force and Air Force Reserve that began with TFAP.

Within TFAP, there are two categories of pilots authorized to participate with ARC units: INEX pilots are on first operational flying assignments, and LIMEX pilots have completed mission qualification training but have not yet accumulated the hours required to be declared experienced.[36] In practice, INEX fighter pilots are not participating; only active-duty pilots who already have completed a minimum of 18 months of training (and often after their full initial 3-year operational tour) are sent to ARC units.[37]

These pilots often achieve experienced status early in their ARC tour, minimizing the full absorption bonus that sending INEX pilots to ARC would give. Sending INEX pilots would maximize the effects of both absorption and ARC experience levels; by sending LIMEX pilots to the ARC, the Air Force is addressing a different issue than absorption. In addition to the absorption problem, active-duty units were finding themselves in a situation where INEX pilots and instructor pilots who were training them flew the vast majority of missions available to the unit. This left the LIMEX pilots with few sorties, and those that were flown often were adversary support for the INEX instructor pilot missions. Both quantity and quality of training were deficient, extending the amount of time it took the LIMEX pilots to reach fully experienced status and instructor status. Again, the problem was feeding on itself by slowing the whole aging process of fighter pilots; TFAP is seen as a way to work around the issue.

The Air Force put in place a linkage between TFAP pilots and an active-duty unit. In practice, these pilots still have limited contact on a once-per-quarter basis with the officer (usually an active-duty squadron flight commander) who writes their appraisal. TFAP pilots are supposed to fly with their active-duty unit to expose them to active-duty operational tactics, techniques, and procedures. In reality, often the ARC aircraft the TFAP pilot flies is of a different design block than the assigned active-duty aircraft; TFAP pilots cannot fly with their active-duty units because of block differences. If there is a mismatch between the ARC and active-duty missions, special compartmentalized security issues may even prevent the TFAP pilot from participating in mission planning and debriefing.

The TFAP concept of operations solution is to have a two ship of ARC aircraft (with an ARC supervisor pilot and the TFAP pilot) deploy to the active-duty unit.[38] This two ship would fly with the active-duty squadron, allowing the active-duty supervisor to evaluate the progress of the TFAP flyer. Unfortunately, no active-duty funding backs this concept. This author dealt with exactly this situation; deploying a two ship (with maintenance support) twice a year was cost-prohibitive, competing directly with other unit deployments and training schools. Additionally, while deployed, the impact to home-station flying has to be factored in. Less aircraft at the ARC unit during the week means less ability to meet the planned flying schedule. The other option is to have the active-duty supervisor deploy to and fly with the ARC unit.

One final long-term issue will bear watching. The linkage to active duty during the TFAP pilot's time with the ARC has been spotty at best. If this lack of visibility translates into lower promotion rates and less lucrative follow-on assignments, as compared to the same age group that remained with active-duty units, the integrated assignments to ARC components will come to be viewed as career-limiting choices. Such a view would have negative implications for the many other total force programs currently being implemented or proposed for future implementation.

Fighter Associate Program

The Fighter Associate Program (FAP) continues the concept of greater integration between the Air Force and Air Force Reserve (AFR) that began with TFAP. Although initially an arrangement between only the Air Force and Air Force Reserve, the program is set to include Air National Guard (ANG) units in the near future. There are several differences between TFAP and FAP. The Fighter Associate Program brings the focus back to absorption, and the program, for the first time, sees aviators from the reserve component flying with active-duty squadrons, in addition to sending active-duty flyers to reserve units. The Fighter Associate Program continues to develop the way administrative control (ADCON) issues will be resolved; successfully setting the ADCON framework will be crucial to plans involving even larger scale integration between active-duty and ARC forces.

As of August 2003, the Fighter Associate Program entered the hiring phase for AFR personnel.[39] Under the Fighter Associate Program, there will be two types of programs: one will have reserve personnel participating in active-duty units; this part of the Fighter Associate Program will be known as reserve associate; programs where active-duty personnel participate with reserve units will be known as active associate units. One full-time support aviator from the ARC and three traditional reservist pilots will be assigned to reserve associate units. An active-duty base may have more than one such reserve associate unit (one per squadron).[40] In addition to aviators, the Fighter Associate Program, for the first time, introduces the concept of blending in AFR maintenance personnel. A maintenance unit will consist of two full-time support and four traditional reservists per squadron. The concept has two benefits. First, the extra maintenance manpower will generate the extra sorties required to support four additional pilots flying with the squadron. Second, AFR maintenance personnel tend to have higher qualifications than their active-duty counterparts, for much the same reasons that exist on the pilot side. The AFR recruits from maintenance personnel separating from the active-duty system capture many highly experienced maintainers. Additionally, the AFR Air Reserve Technician retirement system keeps personnel until the age of 56 (or older). The net effect is very experienced maintenance personnel. By blending AFR maintainers with active-duty maintainers, an experience transfer pays dividends, both short and long term, for the active duty. The Air Force Reserve Command will select the reserve associate pilots. The goal is to hire experienced instructor pilots to have an immediate impact on the absorption equation (Table 3).

One experienced instructor pilot, along with one or two additional INEX pilots, will be assigned to active associate units. The experienced instructor pilot will act as both supervisor and mentor for the assigned INEX active-duty pilots.[41] By reestablishing as an active-duty direct link, the Air Force is better positioned to prevent the issues seen during Project Season. The combined effect of the reserve and active associate units will leverage absorption capability. The combination of additional instructors and more sorties (because of the additional maintenance support) within the reserve associate unit and access to a large pool of experience within the active associate unit will mean better absorption. Once the program expands to include the ANG, absorbing 382 pilots per year starts to become a reachable goal.

The FAP memorandum of agreement goes on to lay out the basics of ADCON, financial management, and status of resources and training reporting. With each integration effort, the Air Force and ARC are putting more thought into the critical components that make the program viable for long-term sustainment. Long-term sustainment will depend on how pilots who participate in the program are treated as they return to their parent component.

The FAP concept of operations sets standards concerning personnel actions to address this concern; pilots returning to

Active Associate	Reserve Associate	Reserve Maintenance
Hill AFB, Utah	Hill AFB	Shaw AFB (2)
Homestead ARB, Florida	Eglin AFB, Florida	Eglin AFB
NAS Fort Worth, Texas	Nellis AFB, Nevada	Langley AFB
NAS New Orleans, Louisiana	Langley AFB, Virginia	
Whiteman AFB, Missouri	Shaw AFB, South Carolina (2)	

Table 3. Active and Reserve Associate Locations

active duty will receive ops-to-ops assignments and Squadron Officer School College slots at the same rate as active-duty pilots assigned to active-duty squadrons. This is a start, but there are historical examples that point to the validity of the *out of sight, out of mind* adage. For years, ARC squadrons have received rated active-duty lieutenant colonels to act as Air Force liaison officers between the ARC unit and the Air Force. In general, promotion rates for these officers historically have been very low, and the tour has been considered a retirement assignment. If active-duty experienced instructor pilots who participate in the active associate program have the same fate, a valuable opportunity will be missed. Instead of developing future active-duty leaders with a strong understanding of the ARC strengths and weaknesses, the active associate program will be either a dumping ground for pilots looking for one last flying tour prior to retiring or a place for the Air Force to put pilots it does not consider promotable. It will take strong program buy-in at the Air Combat Command plans and programs level, and that buy-in will need to be consistent through leadership changes until the program is fully integrated.

Reserve associate pilots will face a similar challenge. They will be out of the day-to-day operations at their home ARC unit for up to 3 years. If higher level leadership positions are not made available at an equitable rate, the program will not draw the type of pilots that would best serve the ARC and active duty. The reserve associate program offers ARC pilots the opportunity to understand current active-duty challenges. The ARC will realize the benefit of this understanding only if it sends its potential leaders to participate in the reserve associate program.

Base Realignment and Closure

The progression from Project Season through TFAP and FAP shows an ever-evolving vision of what the future total force will look like. The 2005 Base Realignment and Closure (BRAC) Commission will play a large part in shaping the Future Total Force concept. The 2005 BRAC Commission is likely to make deep infrastructure cuts, compelling the Air Force and ARC to better match the remaining basing options against their training and operational commitments.

Various forms of BRAC have a long history, dating back to the early 20th century when Secretary of War Henry Stimson sought to consolidate his widely dispersed and inefficient army.[42] Consolidation continues into the present era. There have been four recent BRAC commissions, 1988, 1991, 1993 and 1995. In total, these commissions have reduced the Air Force infrastructure by approximately 20 percent.[43] After a 10-year hiatus, BRAC will be back in force in 2005. Secretary of Defense Donald Rumsfeld has stated that BRAC 2005 will cut as much surplus as the previous four rounds combined, to include at least 25 percent of its remaining real estate.[44] President George W. Bush's FY02 budget blueprint agrees with this level of reduction, indicating a 23-percent excess infrastructure in the Department of Defense and that new rounds of base closures will be necessary to shape the military more efficiently.[45]

With the prospects of the mother of all BRACs looming, the National Guard Bureau is assessing future options. Brigadier General David Brubaker, deputy director of the Air National Guard, presented a BRAC 2005 briefing to the Adjutant Generals Association of the United States on 23 and 24 September 2003. Brubaker is the ANG representative on the Base Closure Executive Group; as such, he is the only ANG member to vote on closure issues. He has stated that with the potential depth of cuts in BRAC 2005 he does not foresee a scenario where the BRAC will spare ANG facilities. In his view, there may be force structure cuts reducing the bottom line number of ANG people. In the past, the ANG has protected personnel by moving them within states, but this may not be an option this time. The ANG has units spread over every state, many states having multiple units with the same or similar missions. The scenario is ripe for both closure and realignment to optimize both infrastructure and force structure requirements.

The ANG has several options available to meet the challenges of BRAC 2005. The ANG Director, Lieutenant General Daniel James III, is looking to consolidate geographically separated units, collocate flying units and units with similar missions within the state, and blend base operation support by positioning ANG units onto active-duty bases, as well as having active-duty elements blend into ANG units.[46] Although James spoke in terms of the ANG, his statements apply equally as well to the Air Force Reserve since the scenario is similar but on a smaller scale.

James' third option of integration between active-duty and ARC components actually began with the integration of the 116th Bomb Wing and 93d at Robins AFB in September 2002.

Robins and Beyond

In June 2001, Rumsfeld announced a reduction in the B-1 fleet to 60 aircraft. The plan was to relocate B-1s from the Georgia ANG at Robins AFB to Dyess AFB, Texas, and Ellsworth AFB, South Dakota. No follow-on mission was proposed for the Georgia ANG. What Rumsfeld had not considered was the strong congressional intervention that resulted. ANG units have strong state ties. As a major employer of state citizens (with a large number of them registered voters), ANG units tend to have close affiliations with their elected representatives. In the end, a General Accounting Office study was conducted to examine possible solutions other than eliminating 1,172 full- and part-time military positions in Georgia.

The result was the inactivation of the 116th Bomb Wing (Georgia ANG) and 93d (active duty) and activation of the 116th Air Control Wing as a total force blended unit.[47] The 116th is the most aggressive attempt at active component and reserve component integration to date. One year into integration efforts, Colonel Bob Doehling, commander of the 116th, laid out many of the challenges facing total force integration.

Under United States Code, Title 10 (Armed Forces) and Title 32 (National Guard), commanders are not one and the same. The law regarding Title 10 versus Title 32 chain of command is being addressed. In the near future, it is likely that a single designated commander will have administrative control across both titles, but for now, a Title 10 commander does not have administrative authority (appraisals, disciplinary action, and so forth) over Title 32 personnel. The same applies for a Title 32 commander and Title 10 personnel. This forced a situation in which the wing had dual tracks of administrative control. The wing commander administered to Title 32 personnel, and a separate chain of authority ran from the Title 10 vice wing commander to the Title 10 personnel. Coalition leadership at the national level often is difficult (Operations Desert Storm, Allied Force, and Iraqi Freedom are good examples of compromise coalition

partnerships). Coalition leadership within a single military organization easily can create schisms with the potential to tear a unit apart.

One integration proposal put forth by the Virginia ANG would bypass this problem altogether. Several reasons led to the current efforts of the Virginia unit to integrate with the 1st Fighter Wing at Langley AFB as it converts to the F/A-22. For much the same reasons that the Air Force elected to move Robins B-1s, high infrastructure costs associated with the F/A-22 (training facilities and specialized stealth maintenance equipment) make farming the F/A-22 out as individual squadrons cost prohibitive. Therefore, the Air Force is looking to locate F/A-22s at a small number of large bases to take advantages of economy of scale. Additionally, as James pointed out, as BRAC reduces the current fighter force by approximately 33 percent, properly positioned ANG units need to look at integration or face a loss of mission. Integration of Richmond and Langley would free up Richmond's 18 F-16s, fueling further integration efforts within the tactical air force.[48]

Although still in the early concept phase, Virginia would look to integrate by moving its entire operations group and maintenance group to Langley (without bringing any aircraft). Once there, they would divide approximately 32 pilots, 180 full-time maintainers, and 240 traditional ANG maintainers between the three active-duty squadrons and would operate under the 1st Fighter Wing as an associate unit. This integration would increase the crew ratio from 1.25 to 1.50. This increase in crew ratio is essential to maintaining the likely high-operations tempo of the F/A-22, while taking advantage of the experience base of the reserve component unit. Administrative control would still fall to the Virginia operations group. By keeping administrative control within the reserve component, the two separate systems would function without some of the concerns mentioned above. As of this writing, it was uncertain what leadership positions within the three active component squadrons (both flying and maintenance) or at the wing level reserve component personnel would hold, if any. Without some representation in leadership positions—as an associate unit without any assigned aircraft—the Virginia ANG unit could find itself with very little influence in decision cycles. During a briefing at the Air War College, General John P. Jumper expressed concern along these lines when he indicated that preserving an ANG unit's identity as it associated with a larger Air Force wing was a major consideration to be worked out as total force develops.

The next question to be resolved will deal with how best to mix leadership coming from very diverse backgrounds with very different career progressions when an integration model like Robins is carried out. With careers often extending until 56 years of age, ANG officers (and senior enlisted personnel) tend to hold jobs for much longer than their active-duty counterparts. At the highest levels, it is not atypical for an ANG commander to hold the position for 4 or more years; Air Force commanders rotate through positions at a much faster rate before either retiring or progressing into the higher ranks available across the Air Force. If an integrated wing has an ANG commander, there are two options. The first option is to leave the ANG officer in command until follow-on positions open up or retirement. The disadvantage in this scenario is that there is no opportunity for leadership positions for active-duty officers. This would act as a strong disincentive to accept an integrated assignment for active-duty personnel. The second option is to rotate the ANG officer out of the command billet commensurate with active-duty rates. Unlike the Air Force, an ANG unit has few positions that such an officer can flow into. Most likely, the officer will be forced to accept a position of lower responsibility (often in the same unit because of Air Force specialty code constraints) or retire. Within the Title 32 technician system, an early retirement is not an option. A situation would then exist where an active-duty commander would have a former commander working for him. This scenario could have adverse effects on the order and discipline within the unit. A simplistic answer would be that there is only one commander as designated by legal orders, but human nature suggests many situations where singularity of command would be eroded. This erosion need not be through deliberate action and may be as innocent as unit members still perceiving the authority of the former commander as still intact.

Another option is to designate either the active component or reserve component as the lead in any integrated wing. As the designated lead, that component would fill the commander positions, and the follow component would contribute lower ranking members to the mix so career progression is not affected. While a viable option, this only works when the reserve component acts as lead at a reserve component facility. The Air Force would have the option to flow officers in the rank of major and below and enlisted personnel of staff sergeant and below through a tour with the reserve component unit before continuing their higher rank career progression within the active component. This would take advantage of the reserve component experience level and seasoning opportunities. If the active component were designated as the lead, reserve component personnel would be locked out of any integrated command positions. In this scenario, few options would exist within the state for follow-on leadership positions. Reserve component personnel would have limited career opportunities.

Since the lead-follow concept does not apply equally to both the active component and reserve component, it may not find favor except in scenarios where it can be applied on a small scale. The Fighter Associate Program (both active associate and reserve associate) is a good example where lead-follow works since both

The next question to be resolved will deal with how best to mix leadership coming from very diverse backgrounds with very different career progressions.

active component and reserve component pilots can flow back to their parent organization for follow-on assignments. When large-scale integration is anticipated, force management will become crucial. A *move after next* progression needs to be considered before installing a reserve component commander, vice commander, or even shop chief. Without having a viable 2-to-3 year follow-on position (or planned retirement), leadership opportunities could be unfairly denied to active component members.

Another issue that Robins must deal with is the demands of a low-density/high-demand (LD/HD) platform. The Joint Surveillance Target Attack Radar System has continuous missions around the globe and a high operational and personnel tempo to match. One of the historical recruiting attractions of the ANG has been limited deployments compared to the active duty. If ANG unit members (both full time and traditional) are tasked to deploy at rates approaching the Air Force, will recruiting suffer? It is still too early to determine long-term trends, but the incompatibility of civilian employment and constant military deployments are sure to take a toll on traditional members. To counter this eventuality, a larger ratio of full-time ANG members may be required. If that is the case, most of the traditional cost benefits of reserve component versus active component units will be lost. Even with additional full-time positions, a strong economy could make recruiting sufficient reserve component personnel difficult as potential recruits (both initial recruits and separating military) find job opportunities without the constant family separation that LD/HD missions require.

Doehling's briefing included a useful summary of the differences between the active-duty and ANG culture.[49] As Doehling's chart (Table 4) shows, an area that reserve component units traditionally have not had to contend with (on anything but a limited basis) is the relative youth of the active-duty members. The reserve component does bring in new members, but these junior members tend to be traditional guardsmen for several years prior to competing for full-time positions. The net result is an older, more mature full-time force with only limited exposure (typically on drill weekends and deployments) to relatively young personnel. As Doehling points out, the ANG has few disciplinary issues in comparison to their active-duty brethren. Dealing with a younger workforce initially will be a challenge for reserve component commanders. Additionally, if integration occurs at a reserve component base, these young people may not have facilities typically provided on Air Force bases. The list includes commissaries, base exchanges, gyms, and housing. The increased costs associated with living off a local economy may be beyond the reach of junior enlisted members. Two solutions exist. First, limit integrated tours to more senior noncommissioned officers (NCO). The downside is that the reserve component level of experience would not be available to those who would benefit the most. The second option is to provide additional allowances to bridge the gap and either add or expand existing facilities located at reserve component bases to handle increased demands. Formal versus casual unit atmosphere is also a concern. Long-term working relationships are typical in the reserve component because of the length of careers and lack of permanent changes of station. This leads to a

Both reserve component and active component leadership and personnel will have to come to terms with the unique nature of each other's culture for an integrated wing to succeed.

Active Duty Culture	Air National Guard Culture
More formal unit atmosphere.	More casual unit atmosphere.
Significant number of disciplinary actions.	Few disciplinary actions.
Large group of underage personnel.	Rarely have underage personnel.
Dormitory living for single junior enlisted.	No one has to live in government quarters.
No UMD slot required for promotion.	Must hold UMD position to promote.
Frequent PCS enhances career.	No PCS likely during career.
EPRs responsibility growth in accordance with rank.	APRs emphasize potential for growth.
Primary worker is SSgt or below.	WG/WL employees are primary workers.
TSgts are supervisors not workers.	WG/WL worker frequently is a MSgt.
SMSgts are not assigned at shop level.	SMSgt assigned at shop level.
Nightshift supervised by junior ranks.	Nightshift supervision same as day.
Officers are primary supervisors.	Enlisted are primary supervisors.
Rank overages do not affect promotions.	Rank overages not authorized.
Excess personnel do not affect promotions.	Excess personnel affect promotions.
Active rank ratio is lower than ANG.	ANG rank ratio is higher than AD.
Separation from Air Force normally slow.	Separation from ANG very quick.

Table 4. Cultural Differences Active Versus Reserve

more informal working environment. Additionally, the Association of Civil Technicians acts as a union and represents nonsupervisory ANG personnel. Working relationships between wing leadership and union leadership can be critical in determining overall productivity and unit harmony. Working through union issues and the formal grievance process will be a cultural shift that active component commanders will need to master quickly. Both reserve component and active component leadership and personnel will have to come to terms with the unique nature of each other's culture for an integrated wing to succeed.

None of these cultural differences is in and of itself a showstopper toward integration. The majority of issues revolve around working the supervisory chain in a fair and equitable manner. The key will be getting the leadership equation right. If both the active component and reserve component provide officers and senior NCOs with leadership growth potential after their integrated tour, then total force integration is likely to succeed. In a decade, a large number of high-level leaders from both components will have intimate working knowledge of their component's strengths and weaknesses. If this occurs, the cultural differences likely will be lessened and the goal of a seamless total force much more probable. If either component fails to provide true leaders and only sends those they consider nonpromotable, then total force integration may very well go the way of Project Season.

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At the time of writing of this article, Lieutenant Colonel Fick was a student at the Air War College.

notable quotes

Appeasement—surrender on the installment plan.

—Arthur H. Vandenberg

Creative Approaches to Improving Segments of the Defense Transportation System

Major Travis Condon, USAF
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With the recently adopted expeditionary and transformational mindset within the Department of Defense (DoD), the need for significant improvements in the military logistics system is recognized widely. Lieutenant General Michael E. Zettler, former Air Force Deputy Chief of Staff for Installations and Logistics, recently suggested that the Air Force logistics community needs to "shed the bureaucratic and organizational vestiges of the past and fundamentally transform ourselves to become more expeditionary, mobile, forward thinking, and more efficient than ever before."[1] General John W. Handy, the commander of US Transportation Command (USTRANSCOM) agreed when he stated the military lacks an efficient supply chain and distribution system to support the warfighter.[2] Moreover, Air Mobility Command (AMC) has been losing cargo delivery business to commercial providers over the last 2 decades, perhaps because of simpler requirements placed on the shipper and better reliability and visibility provided by commercial vendors.[3]

In recent years, USTRANSCOM and the Defense Logistics Agency have taken several measures to begin improving the system. For example, the Strategic Distribution Management Initiative, which attempted to redesign and streamline the DoD global distribution system, significantly improved delivery time to test locations.[4] During its first test in Europe—in July 2000 providing delivery to Tuzla, Bosnia, and Taszar, Hungary—the customer wait time for air-delivery cargo improved from 15 days to 10.7 days.[5] In another attempt to improve DoD logistics processes, USTRANSCOM recently has been designated as the distribution process owner and, thus, is responsible for managing the entire supply chain for DoD.[6] This move is expected to enhance delivery reliability, visibility, and efficiency. [7]

The Air Force also is exploring ways to improve its logistics processes and recently commissioned a transportation reengineering team to determine how to "improve the performance, quality, efficiency, and cost effectiveness" of Air Force air transportation systems and processes.[8] Toward this effort, the team researched and visited numerous military and civilian agencies.[9] The reengineering team identified 20 policies and processes that warrant further consideration for improvement. This article focuses on three broad areas from the report—cargo entry, delivery reliability, and pricing. While manpower and training issues are not addressed, they were discussed in the report.

At a recent supply chain management consortium in St Louis, Handy, discussing the military distribution system, stated he was looking for anybody willing to put his/her brain into the problem. This article is aimed at generating discussion and debate among logistics professionals and encouraging readers to "put their brain to this problem."

Cargo Entry

The Defense Transportation System (DTS), defined as "that portion of the nation's transportation infrastructure that supports DoD common-user transportation needs across the range of military operations," is managed by USTRANSCOM.[10] One element of the Defense Transportation System—the focus of this article— consists of the Air Force providing regularly scheduled air transportation for passengers and cargo to government-approved customers. These regularly scheduled flights, also known as *channel missions,* are established to maintain a distribution network between the continental United States (CONUS) and overseas locations and to train military aircrews.

Before channel cargo enters the DTS airlift system, shippers must receive approval for their cargo by submitting cargo information to the airlift clearance authority.[11] The DoD has three airlift clearance authorities (the Air Force, Army, and Navy) whose purpose is to control the entry of cargo into the airlift system because of limited transportation resources. The information is submitted by completing the advance transportation control and movement document (ATCMD). Shippers can submit the required ATCMD information via the Cargo Movement Operating System at base traffic management offices, faxing or phoning the information to the airlift clearance authority, or using the airlift clearance authority online submission form. Once the documentation is received and approved by the airlift clearance authority, the information is entered electronically into the Global Air Transportation System (GATES).

The shipper's responsibilities extend beyond completion of appropriate documentation. The shipper must package and label the cargo properly in accordance with the Defense Transportation Regulation (DoD 4500.9-R), which ensures cargo airworthiness. Finally, the shipper must arrange transportation of the cargo (usually via surface transportation) to the appropriate aerial port, air terminal, or traffic management office. Thus, before any shipment enters the Defense Transportation System, the shipper is required to ensure the cargo is properly marked, packaged, and documented.

Shippers often rely on commercial vendors, who usually are not familiar with military airlift requirements, to ship their cargo to an aerial port. Consequently, the cargo shipped routinely is improperly packaged. However, regardless of the condition or problems the item might have, the carrier has completed its contractual responsibilities and is not responsible for the original shipper's documentation problems.

After cargo arrives at the appropriate facility for airlift , air terminal personnel inventory the cargo for accountability and check it against the information in GATES. If cargo arrives at the port without an ATCMD in GATES (termed a *no hit* by aerial port personnel), aerial port personnel will enter all the required information. Inputting this information averages 15 minutes per shipment (TCMD) to ensure all information is accurate and complete.[12] At Dover AFB, Delaware, *no hits* represent almost 20 percent of the 21,000 monthly shipments.[13] Thus, at this one AMC aerial port, improperly documented cargo consumes more than 1,000 uncompensated man-hours per month.[14] This problem is recognized at the highest levels—Handy stated at a recent defense logistics conference that 4,500 shipments from DoD vendors arrived at the Dover AFB aerial port during April and June 2003 without proper documentation or notification.[15]

Suggested Improvements to Cargo Entry

The Reengineering Team suggested several improvements to the entry of cargo into the Defense Transportation System.

- Establish a *full service* cargo capability.
- Eliminate the airlift clearance authority.
- Streamline documentation requirements.
- Simplify online access.

A broad, overarching suggestion is that AMC consider establishing a *full service* cargo capability for those customers who are willing to pay to have their cargo prepared for shipment. This service would allow the shipper to deliver cargo directly to a cargo movement facility. Freight personnel would then be responsible for all aspects of originating cargo movement, to include packing, marking, labeling, and documentation preparation. At the cargo movement facility, the customer would see the list of available services and only pay for those services provided. However, customers would have the option of delivering cargo to the port fully prepared for shipment and avoid additional preparation costs. This recommendation not only would provide the DoD with a more customer-oriented service but also would reduce the amount of frustrated cargo, minimize the number of times personnel handle cargo that currently is being frustrated, reduce customer wait time for a portion of cargo, and compensate the DoD for the work.

A second suggestion is to eliminate the airlift clearance authority during peacetime to allow customers easier access to the airlift portion of the Defense Transportation System. By establishing a new pricing and service scheme, the need for an airlift clearance authority is removed. The customer would decide to ship it via AMC or commercial vendor based on price and service.

A third suggestion for improving the logistics system is to streamline documentation requirements. One potential area for cargo process streamlining is to reduce the amount of information required for the ATCMD; the ATCMD requires approximately 25 entries and an 80-digit punchcard format to advance a piece of cargo. Many of the data fields are irrelevant for aerial ports to ship cargo and could be replaced with an additional comment block that prints on the label and manifest. A recent memorandum from the Under Secretary of Defense for Acquisition, Technology, and Logistics calls for the elimination of the 40-year old, 80-column Military Standard System (MILS) format. This memorandum states, "As long as MILS forms the basis of our information exchanges, it will not be possible to track an item throughout its life cycle across the entire supply chain using unique identifiers."[16] Furthermore, the memo mandates that systems that have not migrated off the 80-column format by 1 January 2005 will have their funding withheld.

Another option to streamline the process would be to eliminate the requirement for the 17-digit transportation control number (TCN) and use a simple tracking number for each shipment similar to express carrier operations. Transportation control numbers are generated by shippers and are very easy to manipulate in order to get cargo through the system. Character positions 15, 16, and 17 of the transportation control number allow personnel to circumvent the system, which results in numerous problems such as duplicate transportation control numbers or GATES entries. Another problem with the transportation control number is the limited number of split shipments allowed. The system allows only 22 items to be shipped under one transportation control number. However, shippers often try to ship more than 22 items under one transportation control number. The 22 split limit makes these types of large shipments an intransit visibility nightmare and makes it virtually impossible to locate missing pieces. Simple tracking numbers, generated electronically, would reduce TCN errors and improve supply chain visibility.

A final suggestion to facilitate cargo entry is to make online access to DTS shipment criteria and procedures easier to

navigate. Since the inception of the Internet, the process for advancing TCMDs has been improved. However, trying to find the particular Internet site to submit the required information can be frustrating for new shippers. It could take as many as 12 different screens for the shipper to finally find the right one. Also, if shippers are unaccustomed to AMC cargo terminology or what each specific field in the ATCMD requires, they could overlook or confuse key pieces of data.

Delivery Reliability and Pricing

Shippers have grown accustomed to the reliability and time-definite delivery (TDD) standards provided by express carriers such as Federal Express (FedEx) and United Parcel Service (UPS). In contrast, the Defense Transportation System employs a complicated and somewhat confusing priority system that does not guarantee cargo delivery at a specific time and a pricing system that does not adequately differentiate between available services.

The DTS cargo priority system is governed by the Uniform Materiel Movement and Issue Priority System (UMMIPS). The UMMIPS serves to allocate materiel and logistics resources in accordance with Joint Chiefs of Staff (JCS) and Military Service guidance, while establishing time-definite delivery standards.[17]

The priority system starts determining the force and activity designator (FAD) and the urgency of need designator (UND) indicating the mission essentiality of the cargo.[18] From the FAD and UND, a supply priority designator can be determined. For example, using Figure 1, a FAD of II with a UND of B equates to a supply priority designator 5.

After determining the required delivery date (RDD) and its appropriate code, the supply priority designator is then converted into a transportation priority (TP).[20] Figure 2 depicts the conversion of the supply priority designator into a transportation priority. A supply priority designator of 5, from the example above, translates into a transportation priority of 2.

Thus, to determine cargo movement priority, the shipper must first determine the FAD/UND combination, followed by the supply priority designator; decide the appropriate code to best describe exactly when it needs to arrive; and finally, determine the transportation priority. This complex prioritization process is in stark contrast to the simple and straightforward options provided by commercial carriers.

To further complicate delivery, the aircraft used to deliver cargo has its own separate priority system independent from the cargo priority system. The priorities used to determine the use of Air Force cargo aircraft are designated by JCS priorities. These priority codes direct the use of aircraft to support a variety of missions. These channel airlift missions, which are designated to carry DoD cargo, are prioritized as 1B1, 1B3, or 3A3. There are at least four priorities that are higher than moving channel cargo. Recent changes have allowed some customers to request changing their channel from a frequency channel (1B3) to a contingency channel (1B1).[22] Of approximately 122 worldwide-validated cargo channels, approximately 44 of them are JCS priority 1B1.[23] With this priority system, there can be unforeseen requirements with higher priorities, which may result in airlift being pulled from channel missions to support other, more important missions. Loss of airlift support because of higher priority missions could delay delivery—regardless of the transportation priority of the cargo. There is no direct correlation between JCS mission priorities and cargo transportation priorities.

After all this, the complicated supply and transportation priority system does not provide a specific delivery date as commercial carriers provide. The UMMIPS attempts to provide an upper bound for delivery time by designating time standards for order-to-receipt time, but there is no guarantee these times will be met. Recently, USTRANSCOM, in conjunction with the Air Force Logistics Management Agency (AFLMA), concluded a study showing that previous UMMIPS time standards were frequently not being met.[24] To give customers a more accurate delivery estimate, USTRANSCOM proposed changing UMMIPS to indicate a more realistic delivery standard.[25] These standards, now labeled as time-definite delivery standards, reflect an 85-percent probability that the "wholesale supply system is capable of delivering required material to its customers" within the timeframe stated (Figure 3).[26] For example, the UMMIPS provides a time-definite delivery of 12 days to Area B for TP1 cargo. This means there is an 85-percent probability that the cargo will be delivered within 12 days.

Priority systems usually are used to regulate = available assets while simultaneously meeting the differing needs of customers. Within the Defense Transportation System, the airlift portion from CONUS to overseas generally is recognized as the most constrained segment. Thus, it should be reasonable to conclude

SUPPLY PRIORITY DESIGNATOR DETERMINATION			
FORCE ACTIVITY DESIGNATOR	URGENCY OF NEED DESIGNATOR		
	A	B	C
I	1	4	11
II	2	5	12
III	3	6	13
IV	7	9	14
V	8	10	15

Figure 1. Supply Priority Designator Determination[19]

TRANSPORTATION PRIORITY AND MOVEMENT CONVERSION TABLE			
Supply Priority Designator	Required Delivery Date	Transportation Priority	Mode of Shipment Eligibility
01-03	All	1	Air
04-08	44 555 777	2	Air
09-15	2	3	Surface
	None	4	Surface

Figure 2. Transportation Conversion and Movement Conversion Table[21]

that the TDD standards for TP1 and TP2 should reflect a significant difference for the strategic portion of the Defense Transportation System. However, this does not seem to be the case. The major difference in TDD times for TP1 and TP2 (Figure 4) to Area B is found in the CONUS transportation time—probably the least constrained part of the entire transportation process. Only 10 percent of the time difference between TP1 and TP2 time standards is allocated to the airlift segment, while 70 percent of the difference is given for CONUS transportation time. The differences in TP1 and TP2 essentially have no bearing on restricting the flow through the constrained airlift portion of the Defense Transportation System.

In addition to the priority system, the pricing structure in the airlift portion of the Defense Transportation System is not efficient. Currently, although TP1 cargo is higher priority and is handled before TP2 cargo, there is no difference in cost to shippers for airlift. The pricing is based on the origination, destination, and weight—not priority. The only price break is based on the weight of the cargo shipped (that is, 0-439 pounds, 440-1,099 pounds, 1,100-2,199 pounds, 2,200-3,599 pounds, and more than 3,600 pounds).[29] With this type of pricing structure and lack of delivery reliability, it is logical that shippers will use the highest priority possible to get their cargo to its destination.

Suggested Improvements to Delivery Reliability and Pricing

The following are suggestions to improve delivery reliability and pricing within the Defense Transportation System:

- Provide guaranteed delivery service by reducing delivery time variability.
- Decrease port hold times.
- Place greater emphasis on time-definite delivery and less emphasis on JCS airlift priority and aircraft utilization rates.
- Implement price and service level relationships.

The first suggestion is for the Defense Transportation System to provide a guaranteed delivery service for its customers. Through organic and contracted means, the Defense Transportation System could provide the capability to deliver cargo at a specific time, thus providing true time-definite delivery for its customers. More predictability and less variability in the system are needed, especially when customers are willing to pay higher prices for more reliable service.[30] Guaranteed delivery may reduce duplicate submissions that customers often submit because of a lack of reliability and visibility.[31]

The second suggestion, in conjunction with reducing variability in the UMMIPS time-definite delivery, is for USTRANSCOM and AMC to examine methods to reduce port

			Area			
PIPELINE SEGMENT	**CONUS**	**A**	**B**	**C**	**D**	**EXP**
A. Requisition Submission Time	.5	.5	.5	.5	.5	.5
B. ICP Processing Time	.5	.5	.5	.5	.5	.5
C. Storage Site (or Base) Processing, Packaging, and Transportation Hold Time	1	1	1	1	1	1
D. Storage Site to CCP Transportation Time	N/A	1	1	1	1	N/A
E. CCP Processing Time	N/A	.5	.5	.5	.5	N/A
F. CONUS Intransit Time	1.5	1	1	1	1	N/A
G POE Processing and Hold Time	N/A	3	3	3	3	N/A
H. Intransit Theater Time	N/A	1	1	1	2.5	3
I. POD Processing Time	N/A	2	2	2	2	N/A
J. Intransit, within Theater Time	N/A	1	1	1	1	1
K. Receipt Take-Up Time	.5	.5	.5	.5	.5	.5
Total Order-to-Receipt Time	**4**	**12**	**12**	**12**	**14**	**6.5**

Figure 3. Time-Definite Delivery Standards for Category 1 Requisitions[27]

			Area		
PIPELINE SEGMENT	CONUS	A	B	C	D
A. Requisition Submission Time	.5	.5	.5	.5	.5
B. ICP Processing Time	.5	.5	.5	.5	.5
C. Storage Site (or Base) Processing, Packaging, and Transportation Hold Time	1	1	1	1	1
D. Storage Site to CCP Transportation Time	N/A	1	1	1	1
E. CCP Processing Time	N/A	.5	.5	.5	.5
F. CONUS Intransit Time	1.5	1	1	1	1
G POE Processing and Hold Time	N/A	3	3	3	3
H. Intransit Theater Time	N/A	1	1	1	2.5
I. POD Processing Time	N/A	2	2	2	2
J. Intransit, within Theater Time	N/A	1	1	1	1
K. Receipt Take-Up Time	.5	.5	.5	.5	.5
Total Order-to-Receipt Time	4	12	12	12	14

			Area			
PIPELINE SEGMENT	CONUS	A	B	C	D	EXP
A. Requisition Submission Time	.5	.5	.5	.5	.5	.5
B. ICP Processing Time	.5	.5	.5	.5	.5	.5
C. Storage Site (or Base) Processing, Packaging, and Transportation Hold Time	1	1	1	1	1	1
D. Storage Site to CCP Transportation Time	N/A	3	3	3	3	N/A
E. CCP Processing Time	N/A	1	1	1	1	N/A
F. CONUS Intransit Time	4	2	2.5	2.5	2.5	N/A
G POE Processing and Hold Time	N/A	3	3.5	3	4	N/A
H. Intransit Theater Time	N/A	1	1	1	2.5	3
I. POD Processing Time	N/A	2	2	2	2	N/A
J. Intransit, within Theater Time	N/A	1	1	1	1	1
K. Receipt Take-Up Time	1	1	1	1	1	1
Total Order-to-Receipt Time	7	17	17	17	19	6.5

Figure 4. TP 1 and TP2 Comparison[28]

hold times. As Figure 4 shows, 3 days are allowed for port-of-entry processing and hold time, and 2 days are allowed for port-of-debarkation processing time. For high-priority cargo in the commercial sector, these times are reflected in hours, not days. One approach to reduce port hold time is to match airlift more closely to cargo movement requirements. This would reduce the amount of time cargo sits at a port waiting for movement.

A third suggestion is for USTRANSCOM and AMC to place greater emphasis on time-definite delivery and less on JCS airlift priority and aircraft utilization. Although the JCS airlift priority system may be necessary to manage the limited number of available airframes, mechanisms to compensate for priority changes and ensure time-definite delivery could be implemented. Additionally, aircraft utilization (that is, space or weight used versus space or weight available) is an important measure of efficiency and is easily computed and understood. However, there are costs associated with an unpredictable transportation system, such as increased ordering costs because of duplicate orders, increased inventory, and increased inventory holding costs that are not as easily quantifiable but are important. Perhaps the most important and intangible consequence of an unreliable Defense Transportation System is the lack of customer confidence in the system. By placing greater emphasis on time-definite delivery and providing more reliable delivery, many of these tangible and intangible costs may be reduced.

The fourth suggestion is to implement price and service-level relationships. The DoD could change the pricing structure and charge customers based on the level of service provided (in addition to origin, destination and weight). Customers who require premium, guaranteed service would be expected to pay premium prices. However, customers who are willing to accept longer delivery periods would be charged less but still receive their cargo within a designated timeframe. Offering pricing options would solve the priority inflation problem that continues within the system. Without customer confidence in the ability of the Defense Transportation System to provide time-definite delivery, combined with no cost incentive to use a priority other than TP1, customers will continue to abuse the system to try and ensure their items are delivered as quickly as possible. In fact, a recent General Accounting Office (GAO) report stated, "Ineffective prioritization system for cargo precluded the effective use of transportation assets during Operation Iraqi Freedom."[32]

Conclusion

This article suggests several improvements to three areas of AMC airlift operations: cargo entry procedures, delivery reliability, and pricing. Technological improvements, along with offering a *full service option,* provide the means to make cargo entry into the Defense Transportation System relatively simple and virtually error free while alleviating the need for human interaction in the airlift clearance process. Additionally, with the appropriate measures and price controls during peacetime, technology and costs to shippers could regulate the movement of cargo through the Defense Transportation System. Finally, if decisionmakers are serious about providing genuine time-definite delivery, they need to refocus their priorities from airframe priorities, aircrew training, and aircraft utilization to establishing appropriate processes that ensure cargo is delivered when required.

Admittedly, some of the ideas are rather progressive and would necessitate fundamental changes to the accepted practices, culture, and doctrine at USTRANSCOM and AMC. Implementing these suggestions may require a significant investment of time and money. However, the authors believe DTS customers are looking for far-reaching improvements to current service levels and hope this article contributes to the ongoing transformation within the Defense Transportation System.

Notes

1. Lt Gen Michael E. Zettler, "A View From the Top," eLog21, Bringing AF Logistics into the 21st Century, 24 Nov 03
2. SFC Doug Sample, "General Addresses Supply Chain Problems," *Air Force Print News Today*, 11 Dec 03.
3. Brian G. Chow, The Peacetime Tempo of Air Mobility Operations: Meeting Demand and Maintaining Readiness, Rand Project Air Force, 2003, XIX.
4. Strategic Distribution Management Initiative Underway [Online] Available: https://us.army.mil/frame.html?rtfPossible-true&lang=en, 28 Jan 04.
5. *Ibid*.
6. DoD news release, "US Transportation Command Appointed As Defense Distribution Process Owner," Release Number: 090325-1, 25 Sep 03.
7. Ken Cottrill, "Waging War on Inefficiency," *Journal of Commerce*, 8 Dec 03, 1.
8. "Proposed Implementation Plan for Air Transportation Reengineering," Dec 01.
9. USTRANSCOM, AMC, Tanker Airlift Control Center, Air Force Institute of Technology, Emery Worldwide, FedEx, UPS, and Windswept Enterprises.
10. DoDR 4500.9-R, Defense Transportation Regulation, Part II, Cargo Movement, II-xxxix.
11. Channel airlift—common-user airlift service provided on a scheduled basis between two points. There are two types of channel airlift. A requirements channel serves two or more points on a scheduled basis, depending on the volume of traffic; a frequency channel is time-based and serves two or more points at regular intervals, *DoD Dictionary of Military Terms*.
12. Author's telephone interview with Capt Robert Neal, Dover AFB Aerial Port Commander, Air Terminal Operations Flight, 28 Jan 04
13. Author's telephone interview with Capt Robert Neal, Dover AFB Aerial Port Commander, Air Terminal Operations Flight, 22 Jan 04.
14. Author's telephone interview with Capt Robert Neal, Dover AFB Aerial Port Commander, Air Terminal Operations Flight, 29 Jan 04.
15. Sample.
16. The Under Secretary of Defense, letter to Secretaries of the Military Departments, "Migration to the Defense Logistics Management Standards and Elimination of the Military Standard System," 22 Dec 03.
17. F/AD. A Roman numeral (I to V) that the Secretary of Defense, the Chairman of the Joint Chiefs of Staff, or a DoD component assigns to a unit, organization, installation, project, or program to indicate its relative mission essentiality.
18. UNDs are used respectively to describe the importance of any given item to any specific mission. UND A—requirement is immediate. Without the material needed, the activity is unable to perform one or more of its primary missions. UND B—requirement is immediate, or it is known that such a requirement will occur in the immediate future. The ability of the activity to perform one or more of its primary missions is impaired until the material is received. UND C—requirement is routine.
19. Joint Pub 4-01, Appendix A.
20. A three-position field that is used to identify the level of service (in terms of time) that a customer requires of the logistics system. The RDD specifies the allotted times that each element of the logistics system has to satisfy the service-level required by the customer. The logistics management systems use the RDD to determine the service-level times that must be met or exceeded and allocate their resources accordingly. An RDD of 999 indicates an expedited handling requirement for nonmission-capable supply overseas customers or CONUS customers deploying within 30 days. This RDD applies to requisitions with priority designators 01 through 03 and is reserved for US forces. An

(continued on page 47)

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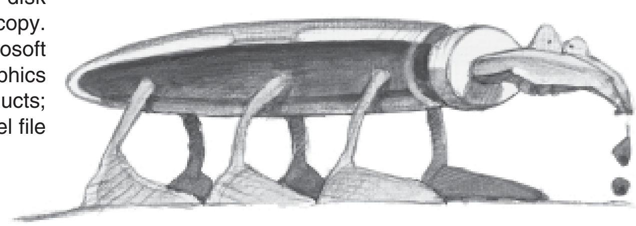


Lessons for Transforming Logistics

The issue of technology is becoming the forefront of American procurement and acquisition issues. As the Germans did in 1935, America now enjoys a technological superiority over friend and foe alike. At the present, there is no match for American technological know-how and application. Yet, this technology is only as good as its application.

logistics history

From First to "Wurst:" The Erosion and Implosion of German Technology During WW II

As the Air Force begins its fourth major transformation in 11 years, there are some striking similarities between what it currently faces and those challenges faced by World War II Germany. Notable among them is a strong sense of nationalism. Currently, there is no real centralized control over the US Armed Forces acquisition program. As it was for the Germans in 1935, US Armed Forces currently follow separate stovepipes for acquisition of weapon systems. For the Germans, the result was an egregious waste of valuable and limited resources, both natural resources and dollars. The Air Force, today, faces much the same challenge as the Luftwaffe, specifically determining mission and needs. As the Luftwaffe vacillated between a fighter and bomber, the same struggle goes on today in the US Air Force. While not a concern for the Luftwaffe, the American conundrum is compounded by the oft-overlooked integration of space into the battlespace. This merely compounds the larger issue facing the Air Force today, that of identity.

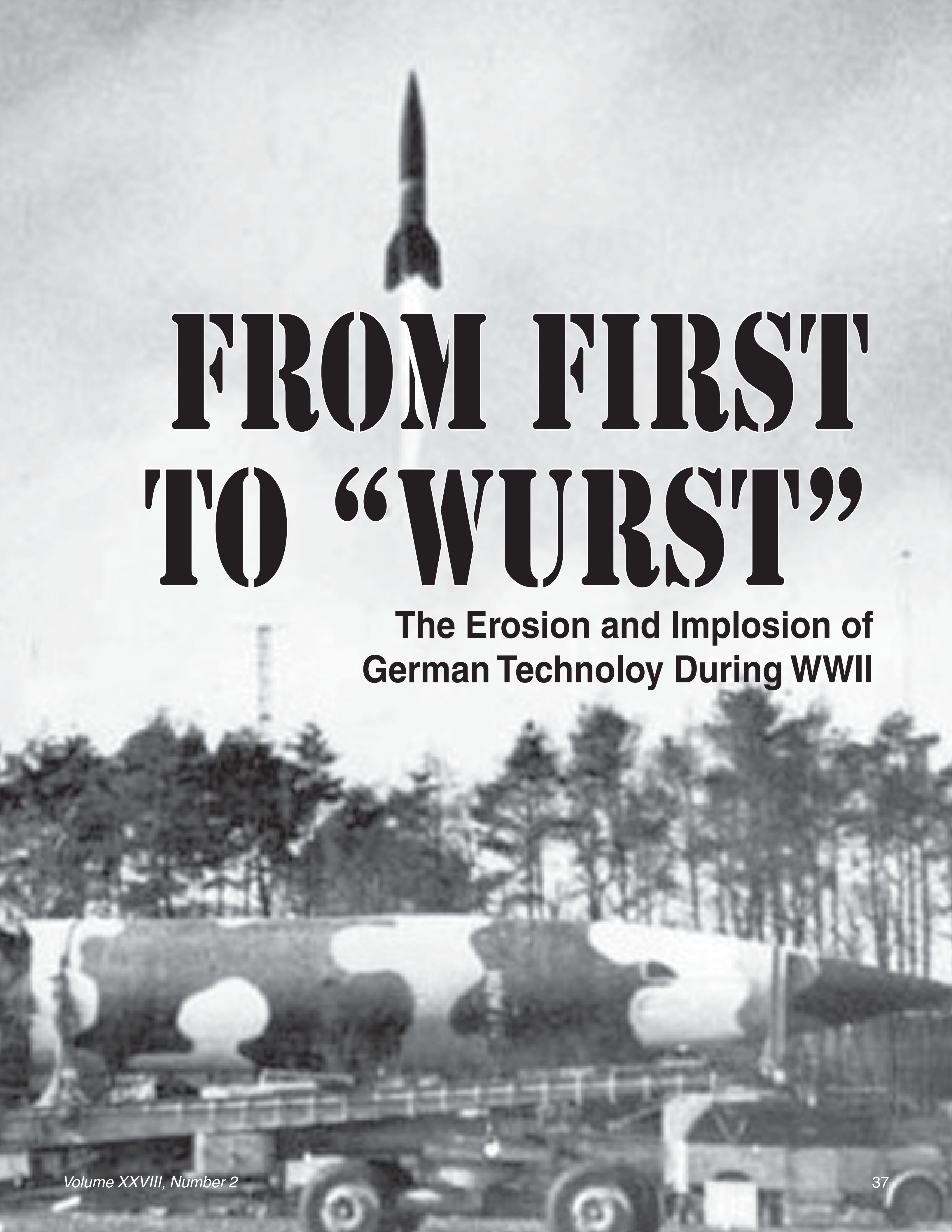
The German management system, especially in terms of the technological industry, was a complex and convoluted bureaucratic nightmare.

Major Charles A. Pryor III, USAF

In the Beginning

At the outset of the German buildup for World War II, the Germans were, arguably, the most technologically advanced nation in the world. Despite the limitations in the Treaty of Versailles, they secretly designed and built some of the most advanced aircraft in the world. From research into all metal aircraft, such as the Junkers Ju 52,[1] to the Messerschmitt Me 262, the world's first jet fighter,[2] the Germans were on the technological front lines. Yet, in a scant 10 years, the German nation ceased to exist. After the war, with its country divided in two, the technological advances were divided among the conquering powers. Indeed, the battles 5 years later between the Mikoyan-Gurevich MiG 15 and the F-86 were more among German engineers than among the nations actually at war.[3] The reasons for the implosion of the German state are manifold, two of which are addressed herein.

From a technological standpoint, many of the German designs and innovations remain valid. They were the true innovators of some of the world's current aircraft. Indeed, the Germans pioneered the use of wind tunnels, jet aircraft, pusher propellers, metal aircraft, and rockets in an attempt to overwhelm their Allied adversaries. Under the guise of Operation Paperclip, many German scientists and engineers were brought to America to work their magic on the American industry. Despite all this talent and its potential, few of the German designs were actually used during the war. Although their relevance is unquestioned, especially in view of current American (and worldwide) aircraft, they were untapped by the German leadership.



FROM FIRST TO "WURST"

The Erosion and Implosion of German Technoloy During WWII

The German management system, especially in terms of the technological industry, was a complex and convoluted bureaucratic nightmare. Their system of committees and rings, coupled with a lack of centralized control at the top, served to undermine an economy that was resource-poor, in terms of both monetary and natural resources. This mismanagement, exacerbated by the effects of the Combined Bomber Offensive, transformed the German industry from one of the best to one of the worst, a system ready to implode had it not been helped on by the Allies. Further compounding the situation was the influence of Adolf Hitler. A man with a continental worldview and a penchant for doing things his way, Hitler was more of a hindrance to industry than a help. His constantly changing requirements led to costly and lengthy delays to the production of many aircraft. His inability to look beyond continental Europe from a practical standpoint ensured the German state never had a practical long-range bomber until it was too late. Indeed, the Germans ended the war with the same fighter and bomber with which they began the war, with only minor modifications and a dwindling ability to mass-produce them.

Many of the lessons from the German experience with technology and management are applicable today to the US Air Force. Without a doubt, today, the United States is the technological superpower of the world, yet it is plagued by many of the same problems that the Germans faced. Many of America's technological advances seem to be done for the sake of technology, rather than for an operational military need. Indeed, many of the needs of the American military may be met, in the short term, with existing technology or modifications thereto, rather than new programs. The true transformation of the American military and its technology will be a departure from the stovepipes of military acquisition, in which each service acquires its own (often redundant) systems, to a process of standardization among the equipment used to meet each service's needs. Furthermore, American military management is becoming as complex as that of the Germans. True, Americans have much more to worry about than the Germans; for example the whole, poorly understood realm of space. The United States tends to solve its lack of understanding with additional bureaucracy, which exacerbates the overall situation. Alignment under a specific, overarching unified command could eliminate some of the waste and ensure an interoperable, standardized force for the future. Indeed, if the Department of Defense (DoD) does not learn and heed the lessons of the past, it is doomed to repeat them.

This article examines the efforts and impacts of German technology, both during World War II and today. Furthermore, it examines the impact and folly of German management of the technological industry and that industry's subsequent implosion. Finally, this work draws some parallels between the World War II German system and the current American system, fully recognizing the difference between the totalitarian German state and the democratic American state. Despite the glaring and obvious difference between the two, there are similarities that could have a negative impact on America's ability to wage war.

Technical Marvels

At the outset of World War II, the Luftwaffe was, undoubtedly, the world's supreme air force. It had the most advanced fighter and bomber aircraft and the best trained crews. Despite this, the Luftwaffe suffered severe losses during the course of the war, including the loss of air superiority over continental Europe, which led to the downfall of the Third Reich. Its loss can be attributed to several factors, not the least of which was its inability to take advantage of, or maintain, the technological superiority enjoyed at the outset of hostilities. The technological superiority was not limited to aircraft fielded during the war but includes some interesting technical innovations that arose during the war but not fielded by the Luftwaffe. Many of these technical innovations are just now being exploited to their fullest potential. Indeed, many of the technological innovations taken for granted today were first developed in the factories and design laboratories of Messerschmitt, Heinkel, Arado, Focke-Wulf, Henschel, and Junkers. These companies—and the designers for whom they are named—were at the forefront of technical innovation during not only their time but also current times. Many of their innovations—such as canards, boundary layer control, sweptwings, variable wings, jet engines, and more—are widely used today and accepted as industry standards. By examining Luftwaffe technological innovations, we can see a clear inspiration and technological marvel that transcends the aircraft industry today and whose impact is just being realized.

Wind Tunnels

One of the most enduring innovations of the Luftwaffe was its pioneering work with wind tunnels.[4] These devices allow an aircraft, or representative model, to be tested under conditions closely simulating those encountered during flight. By using inexpensive scale models of the aircraft, the engineers were able to determine if their design could withstand the rigors of flight across the spectrum of the flight regime. By varying wind velocity, the German engineers were able to simulate high- and low-speed flight regimens. Similarly, by varying wind velocity, they could examine high and low angle-of-attack regimes. By combining the results of these two areas of study, they could determine the robustness and feasibility of the design in relative combat situations. The essential information that arose during these tests was the feasibility of the design, answering several fundamental questions: would the wings remain attached at high speed and high angle of attack; would the aircraft stall at low speed and high angle of attack; what are the impacts of adding externally mounted items to the aircraft; what would happen to the aircraft once an externally mounted device was dropped (would it become unstable, thus unflyable); and what are the impacts on the aircraft center of gravity? These are fundamental questions concerning the flight worthiness of the aircraft that could be ascertained without having to risk the loss of a prototype or pilot.

Additionally, wind tunnels allowed for the testing of new technologies to smooth the flow of air across the wing. The Germans tested boundary area fences, leading-edge flaps, and boundary layer control, all in an effort to affect the flow of air across the wing surface.[5] With the straight, perpendicular wing style of the day, these aerodynamic controls would ensure the flow of air across the top of the wing was as smooth as possible, thus making the airflow faster and generating more lift. This increase in lift would generate more maneuverability in fighters and more load capability in bombers and more range in both types of aircraft. They tested each of these on many of their experimental designs, but the results of this work only were beginning implementation at the end of the war.

Although the wind tunnels continued to operate throughout the war, their later years' usage was confined to refinement of the V1 and V2 rocket designs. Their staffs were increased in numbers, although those numbers were not used for testing; rather, they were used to mass-produce both weapons. The wind tunnels did stop work during the war after Peenemunde was bombed during the Combined Bomber Offensive, but this was only a brief work stoppage. Once the wind tunnels were relocated to Kochel, they were operational again. Despite this extraordinary testing, the German leadership was determined, by 1944, to focus all efforts on the defense of the Reich. Thus, the tunnels were not utilized to their full potential. The efforts of the personnel assigned to the tunnels were focused solely on one weapon system, not toward testing new technologies or capabilities. This failure to take full advantage of their technological capabilities is a true failure of the German leadership.[6] Indeed, the Germans missed out on several opportunities to exploit fully the wind tunnels, especially in the area of wing design. In this case, the designs were robust and innovative but were not tested by the Germans. Many designs were not tested and developed until long after the war.

The Wings of Man

To increase range and speed, one of the most enduring German technological innovations was the sweeping of wings. During the war, the Germans experimented with a variety of wing sweeps and designs, many of which are prevalent today. Indeed, the most enduring innovation of the Luftwaffe engineers was the rear sweep to a wing, which was found on many of the experimental aircraft designed during the war period.[7] Again, with an eye toward speed and range, the rear sweptwing offers a unique way of increasing lift without increasing weight. By canting the wing aft, the actual lifting area of the wing increased because of the distance the air must flow over the wing. This is done without increasing the surface area of the wing and incurring the corresponding weight penalty, resulting in an aircraft that has greater speed, payload capacity, and range (although all three must be balanced).

The tradeoff with this, however, is limited low-speed maneuverability. The reason here is the specific area where lift is generated. As with all perpendicular and rear sweptwings, the actual lift is generated at the wingtips due to the directioning of the laminar (air) flow over the wings. With perpendicular wings, this lift is approximately abeam the center of gravity on the aircraft, allowing low-speed flight and relatively high angle of attack. With rear sweptwings, the lift is aft the center of gravity, making low-speed flight unstable, thus dangerous. Therefore, by sweeping the wings aft, they were able to gain speed, lift, payload, and range while trading off low-speed maneuverability. The question the German engineers faced then was how to keep these increases without sacrificing the low-speed regime. Their answer was twofold: increase power (without the weight penalty) and change the sweep of the wings in flight.

One of the earliest proposals, although the Germans never flew it, was a swivel wing. Designed by Blohm and Voss, the idea was to have a single wing that would rotate from perpendicular to canted, depending on mission flight parameters.[8] This aircraft then would be able to take advantage of the low-speed characteristics of a perpendicular wing as well as the high-speed characteristics of a canted wing (less drag, more lift). This concept, although viable, was not proven until the National Aeronautics and Space Administration flew an oblique wing on the Ames AD-1 research aircraft in 1979.[9] Another wing technological approach to overcome the low-speed and high-speed maneuverability tradeoff came through the use of variable sweptwings. Familiar today for application on the F-14 Tomcat, the variable sweep technology is designed to move both wings from a perpendicular configuration at low speed to a rear swept configuration at high speed for the aforementioned reasons. A similar variation yielded the experiments into a solid delta-wing configuration, which consisted of a swept leading edge with a perpendicular aft edge and solid material in between, which yielded some successes but not until long after the war ended.[10]

One of the technological innovations the Germans actually flew in prototype was forward sweptwings. In this instance, Junkers took a conventional wing and swept it forward instead of rear. Coupled with jet engines, this aircraft more than compensated for the low-speed maneuverability liability of rear sweptwing aircraft.[11] By sweeping the wings forward, Junkers changed the lift characteristics of the wing. No longer was lift generated at the wingtips, but with forward sweptwings, lift was generated at the wing root, which was adjacent to the center of gravity. The drawback to this design was the directioning of the wingtip vortices. In rear sweptwing aircraft, the vortices generated by the wind movement across the wing (a spiraling whirlwind) are directed across the wing and behind the aircraft causing little effect to the handling. In the case of the Ju 287, these vortices were now directed along the wing toward the fuselage, making high-speed or high-angle-of-attack flight dangerous. During high speed or high angle of attack, the vortices would overcome the elasticity of the wing, causing the wing to twist off. This difficulty was not overcome until the American X-29 program in the 1980s. Although not currently used, forward sweptwing technology provides a short-term capability, one that is already proven.

All these experiments into increasing speed, range, lift, and payload were never incorporated into the German production. Many were exploited after the war, however, and remain in use today. Facing an ever-expanding war situation, Hitler issued a series of Fuehrer directives in September 1941 that curtailed work on nonessential projects.[12] Hitler's continental worldview was coming into direct conflict with his strategic expansions. By attacking Britain and later Russia, Hitler overtaxed his economic capability to conduct a strategic two-front war.[13] His economic focus switched to producing existing technologies en masse to stem the staggering losses of his overreach. In essence, he sacrificed quality and innovation for quantity.[14] This is prevalent throughout the Germans' technological innovations.

My Grandma Wants to Fly Jets

The second technique available to the Germans for increasing the lift, speed, payload, and range of their aircraft was to couple the rear sweptwings with jet engines. These engines were able to generate much more power than their propeller counterparts and could run on alternate fuels.[15] Although Messerschmitt was the first company to produce a jet aircraft, the first to design and test-fly one was Heinkel.[16] Heinkel actually began his research with the experimental He 178 by coupling jet engines with a perpendicular wing as a planned proposal for a two-engine fighter

contract. This never panned out for Heinkel,[17] but Messerschmitt was able to couple the jets with a rear sweptwing design that became the Me 262, the world's first jet fighter. Alas, the Me 262 never entered full production, primarily because of an argument between Hitler and General Adolf Galland over its specific role. Galland argued for the Me 262 to be a pure fighter aircraft, but Hitler was interested in making it a fighter/bomber. This led to a redesign of the Me 262 from fighter to fighter/bomber and back to fighter toward the end of the war.[18] The Me 262 did see some action against Allied bombers, but this was very late in the war, and it did not have much impact on the outcome of the war. Although a successful design, the Me 262 was fraught with powerplant problems. The Jumo 004, the primary jet engine of the time, had a service life of 4-5 hours before it had to be replaced, making the maintenance and logistics of this aircraft cumbersome.[19]

Messerschmitt and Heinkel were not the only ones to experiment with jet engines. Arado had an impact on the US Navy F7U-3 Cutlass of the Korean era.[20] The centrifugal jet engine developed by Focke-Wulf became the primary powerplant for the Yakovlev Yak 15, the first Soviet jet aircraft, used during the Korean war era.[21] Arado also had success with the Ar 234, the first high-altitude, jet-powered reconnaissance airplane.[22] This aircraft was the precursor to the SR-71 Blackbird and the U-2 Dragon Lady. Although these designs had impacts after World War II ended, only the Me 262 was produced in any appreciable quantity by the Germans, and this was late in the war, after the war had been lost.

The Eyes Have It

In addition to out-of-the-box thinking on aircraft design, the Germans were also the first to field and operate an instrument system, both for their own airfields (a precursor to the current instrument landing system [ILS]) and for directing their planes to a target. The first was the Lorenz beam system for blind landing, which consisted of two transmitters located on opposite sides of the airstrip runway. Both transmitted in simplified Morse code, one solely dots, the other solely dashes. The spacing of the dots and dashes was such that, where beams overlapped, a continuous tone was heard.[23] By moving left and right until the continuous tone was heard, the pilot would be aligned directly on the airstrip center line. Thus, in conditions of restricted visibility, the pilots could find their airfield. The limitations of the system were many. It did not take into account crosswinds or turbulence.[24] However, as pilots became skilled in the operation of this system, they could compensate for these difficulties and keep the continuous tone.

The other disadvantage to this was the lack of altitude information. The beams would guide a pilot to the airstrip, but in conditions of zero visibility, they did not provide altitude. This can be overcome by the directioning ability of the transmitters. Essentially, the overlap portion of the beams (the area with the continuous tone) was conical. As the pilot flew toward the airfield, the cone narrowed toward the centerline. Thus, the absence of a tone could indicate the pilot was too high, and he could compensate accordingly. All in all, it is a risky system, but it is better than nothing. Without this, the pilots would have to divert to another airstrip, one not weathered in, which further added to the distance they needed to fly. This became a significant factor during the Battle of Britain when the German fighter escorts were flying at their maximum radii. Any additional flight time or distance could prove disastrous.

The offensive adaptation of the Lorenz system was known as the *Knickebein* system. Designed to be a long-distance target designator for use during night bombing, the Knickebein system consisted of two Lorenz transmitters, one that looked at the target along the ingress line, the other at the target from the profile. The pilots, using the Lorenz system in reverse, would fly away from the first transmitter while maintaining the steady tone in their headphones. Once they were in range of the target, they would switch to the frequency of the second transmitter, while occasionally checking with the first transmitter to ensure they were still on the proper vector. When the second transmitter gave them a steady tone, they were directly over the target and could release.[25] A subsequent refinement of this system, known as the *X-Geraet*, followed the same logic as the Knickebein system, with some refinements. Instead of using the beam intersection to mark their target, the pilots would fly the original beam toward the target. The second transmitter was actually a collection of transmitters, each of which would broadcast on a particular vector. Where each beam of the second transmitter intersected the first beam, the pilots had to hack a certain distance from the target. The *X-Geraet* pilots then would drop flares to literally light the way for the planes that followed.[26]

A further refinement of this technique was the Y-Geraet system, receiver and transmitter combination, where the aircraft will fly a designated vector and periodically retransmit a signal from the ground transmitter. A ground receiver would pick up the retransmitted signal. By calculating the phase shift, the difference in time between the transmitted and received signals, ground controllers had a picture of whether or not the pilot was on vector and could correct their pilots accordingly.[27] This type of ground control (although not the *Y-Geraet* style system) is used today by the ground tactical air control squadrons.

The advantages of these systems, despite their drawbacks, are obvious from the German point of view. They had the ability to direct and control their aircraft as well as recover them in less than optimal conditions. These systems also facilitated night bombing, which adds a psychological effect to the physical effect and destruction. From the British point of view, these systems were of import as they were easy to overcome. Radio frequencies operated over long distances are easy to disrupt once the transmit and receive frequencies are known. The Germans kept their systems simple, using dots and dashes on prescribed frequencies, but the British overcame this by inspecting aircraft that had been shot down. The British did not need to know what to listen for once they had the frequency. Using a technique known as meaconing, whereby the British flooded the various German frequencies with extra traffic, the British were able to defeat the Knickebein and *X-Geraet* systems.[28] To overcome the *Y-Geraet* systems, the British merely jammed the frequency.[29] Despite their limited operational life, these systems were the predecessors to the current ILS and radar systems, both of which allowed for night bombing. As the Combined Bomber Offensive demonstrated later in the war, the Allies were able to keep pressure on the German homeland through daylight bombing by American planes and night bombing by British planes. Without radar and ILS, these night bombings would not be possible, providing the Germans with time to reconstitute or continue production without feeling the effects of bombing.

Subsequent Aircraft Technologies

Faced with the challenge of designing aircraft that could outperform their enemies, the German engineers looked at ways to improve the speed, maneuverability, and altitude of the fighter force. The root reason for this work was the theory that to defeat the Allied bomber streams they would have to attack them at their weakest point, which was from above. Thus, they needed aircraft that could fly at extreme altitudes. In addition to their work on jet engines, the Germans looked at ways to improve propeller-driven aircraft. One of the technical solutions to this problem was fielded in their fighter force. They replaced the old radial air-cooled and liquid-cooled engines with a high-compression piston engine. Essentially a sealed, self-contained engine that was not dependent on a bladder of coolant, this engine allowed fighters to perform negative *g* or inverted maneuvers.[30] This gave them a significant maneuvering advantage when engaging enemy formations. Additionally, this engine would increase the performance envelope of the bomber fleet, allowing them to fly farther than they could with the radial engines. Alas, the performance increase in bombers was not enough to have a significant impact on the war, but the impact of the souped-up fighters was felt. The Allies were able to counter this added threat; however, the Germans succeeded, at least initially, in almost equaling the score with their fighters. Additionally, by examining defeated aircraft, the Allies were able to capitalize on German technological advantages.

Another engine modification fielded by the Germans in limited numbers was a relocation of the engine and propeller. Some of the German aircraft that flew as prototypes had pusher-type propellers. Located at the rear of the fuselage, these pusher propellers were more efficient in terms of fuel usage than traditional puller propellers. The Germans were never able to capitalize much on pusher-propeller aircraft during the war because of their management practices, but the pusher propeller is in use today on long-duration aircraft such as the Predator. Although these were significant technological innovations, ones that have endured and are still in use today, the Germans were unable to capitalize on them because of their failure to properly implement modernization and upgrade their aircraft fleet. As indicated earlier, the German industrial capability was stressed to maintain production of existing aircraft to counter the Allied mass of aircraft. This left nothing for development of new technology.

The interwar years saw the rise of Lufthansa as a commercial airline of the Weimar republic. Headed ostensibly by Hugo Junkers, the main workhorse of the Lufthansa commercial fleet was the Ju 52, an all-metal commercial airliner. The Ju 52, pressed into service during the war as both a cargo aircraft (people and materiel) and a limited bomber, had the capability to carry more items than the previous wood and canvas aircraft. To offset the additional weight, Junkers put on a third engine. This venerable aircraft saw service throughout the war, although primarily as a cargo and troop carrier, eclipsed in the bomber role by the He 111 and Ju 88. Nevertheless, most aircraft built during the war were made of metal, thus more robust and survivable than the previous wood and canvas design. The use of metal aircraft also allowed German engineers to examine the possibility of pressurized cabins.[31] During the war, pilots who flew above a certain altitude were required to use oxygen to counteract the effects of altitude. As an aircraft rises in altitude, the oxygen concentration in the ambient air lessens. If an aircraft flies high enough, it can lead to oxygen depravation, causing the pilot and crew to black out. With the advent of pressurized cabins, the aircraft would be able to fly higher without the requisite oxygen aboard. By pressurizing the cabins, the ambient air within the cabin maintains the same oxygen concentration as it would sitting on the ground, negating altitude sickness and oxygen depravation. Although the Germans never fielded this, it is in wide use in all aircraft applications today.

Good Ideas, But…

Throughout World War II, the Luftwaffe sought to maintain its technological superiority over the Allied forces do this by designing capabilities into their aircraft that would allow them to fly higher and faster than the Allied aircraft.[32] This led to an "explosion of new project activity unequalled in the history of aviation, an explosion that was fueled even further in 1944 by the lifting of all patent protection."[33] The German aircraft industry was populated with some of the premier engineers and designers of the time who were able to come up with some truly revolutionary ideas for designing and building aircraft. The Germans were the first to design and use jet engine aircraft, metal aircraft, instrument navigation, sweptwing technology, and advanced testing through wind tunnels. Some of their more radical designs, such as the Gotha flying wing concept,[34] would not be realized until many years after World War II. Indeed, many of their innovations were picked up quickly by the Allied forces. Bower astutely notes:

> Since 1945, the genesis of weapons by all four Allies has been dominated by the inheritance of Germany's wartime inventions. Indeed, the Korean War can be viewed, on the technical level, as a trial of strength between two different teams of Germans: those hired by America and those hired by the Soviet Union. The aerial dogfights between the Soviet MiG-15 and the American F-86 Sabres—both designed by German engineers—dispelled for many their doubts about the expediency of plundering Germany's scientific expertise.[35]

Thus, the Germans did not lack grand and effective technological innovation. Yet, they were resoundingly unable to take advantage of this situation and were completely unable to bring these revolutionary concepts into operation. The reasons for this are manifold, but the centermost reason for their inability to exploit their technological superiority lay with the complex, convoluted, and inefficient management system in place in Germany during World War II.

Management for Dummies

One of the most overlooked practices in the business of technological innovation is the impact of management on the overall process. Management of technology is crucial to the successful implementation of revolutionary ideas and processes. Management needs to be not only knowledgeable about the designs and ideas of the engineers but also receptive to them. Management needs to provide a roadmap to what is to be accomplished. Without clear-cut direction, meaning a vision and goal not micromanagement, any technological advance is doomed to irrelevance. An overall strategy will provide the engineers with the proper vector to direct their abilities and ideas. Furthermore, management needs to provide clear and unambivalent boundaries to the efforts of the engineers to ensure

the technological innovations and ideas stay focused and attainable. Finally, the management structure needs to be streamlined and simple to allow ideas to flow not only laterally but also vertically. Binding management to a complex and suffocating bureaucracy will have the same effect on the industry as a whole.

Alas, the Luftwaffe found itself in just such a predicament during the war. It had a complicated and convoluted approval process for the technological advances forwarded, one that was wasteful of not only resources but also time. It had little strategic direction and no boundaries on the effort to advance technology. It also had the wrong people in charge of the various agencies that headed up, collectively, the overall effort. The result was a host of revolutionary innovations that would have all but guaranteed they remained technologically superior but were doomed to be merely paper tigers by the bulging management process and poor leadership. These paper tigers were exploited by the Allied powers after the war, but the Luftwaffe was unable to take advantage of them. The overall operational result was an air force that ended the war with the same equipment with which it began, quality equipment at the start but obsolete in 1945 when compared with the equipment of the Allies.

Who's in Charge?

At the core of the management of Luftwaffe technology was Hermann Goering. As Hitler's duly appointed head of the Luftwaffe, he was responsible for ensuring the Luftwaffe had the necessary tools to prosecute the war. The Luftwaffe was responsible for determining its own requirements to ensure it could fight. Similarly, the navy and army each had that responsibility. While this is to be expected, what was lacking in Germany overall (and the Luftwaffe, in particular) was centralized control. There was no one agency in charge of military procurement. Indeed, "production was pitifully small. The fault lies clearly with the Technical Office whose lack of initiative cannot be ignored and with the Luftwaffe General Staff...which failed completely to provide the guidance expected of it."[36] Thus, there was no direction, no vectoring of the effort to ensure the proper item was developed. In other words, there was no one in charge.

Further complicating the effort was the process for placing something on contract. The Luftwaffe would award a production contract for an aircraft based solely on its design.[37] This essentially skips the research-and-development portion of modern-day acquisitions, with the Luftwaffe assuming the risk that the design will not work. In many cases, the prototypes developed did not meet expectations (or requirements).[38] Thus, large quantities of resources were spent and expended for something that did not work. This is an incredibly ineffective way to manage a contract. Further increasing the drag on the resources was the number of programmatic changes enacted. With the swift progress of the war and the swifter progress of implementing minor technological changes, the German factories and modernization centers were hard-pressed to keep up.[39]

Finally, to keep the costs from escalating beyond what was already wasted, the Germans enacted price fixing for the industry. Essentially, a contractor could choose one of three pay categories: one which they were not taxed (but had to be a low contract bid), one where they were taxed, and one where they were taxed and some of their costs recouped. The latter only could be chosen with approval from the government.[40] In essence, from a fiscal point of view, German management of the contract process was a shambles. Valuable resources were wasted by betting the design would work, and the designs were changed constantly, costing more resources and further straining an industry that was undermined by fixing prices to the advantage of the government. This poor fiscal policy was further convoluted by the complicated organizational structure of the German industry.

Early German industrial organizational structure was an attempt to maintain centralized control over industry as it attempted to shift to a wartime footing. In each of the industries of the Third Reich was one person at the head. Directly beneath the head was a main committee, made up of the industry leaders. Ostensibly, the function of this main committee was to evaluate the way each of the companies in the industry did business, select the best from each, and have all factories implement these best practices. Further refining this process, there were special committees under the main committees that dealt with specific parts of the whole. These special committees were also responsible for implementing best practices among their subordinate factories in an effort to increase standardization and efficiency and reduce cost.[41] In theory, this seems to be a sound business practice; however, management by committee (or in this case, by many committees) was not very practical. When combined with poor fiscal guidance and a lack of strategic direction, this system merely complicated the problem.

Furthermore, in 1940, a system of rings was introduced into the industry. These rings were essentially committees but not limited to one industry. These rings were concerned with items and issues that transcended all industry. For example, the ring concerned with the making of steel would have an impact on all committees who used steel (which was all of them). The system that finally evolved consisted of "4 main rings for subcontracting and 8 main committees for the finished product."[42] Each of these committees and rings had subcommittees and subrings to them, further increasing the bulging bureaucracy. Known as Self-Government of Industry, this system could be effective in the hands of a skilled manager like Albert Speer. The armament industry under Speer became more efficient and productive[43] despite the complicated system. However, under managers like Karl-Otto Saur, the opposite happened. Indeed, as Goering stated:

> Saur was a man completely sold on figures. All he wanted was a pat on the shoulder when he managed to increase the number of aircraft from 2,000 to 2,500. Then the Luftwaffe was blamed that we had received so and so many aircraft and where were they.[44]

Unfortunately, for the Luftwaffe, this thinking tended to dominate the war-production effort. The result was a gross number of aircraft (quantity), many of which were unusable or obsolete (quality).

Quantity Versus Quality

One of the toughest challenges faced by management in a technological industry is the issue of quantity versus quality. Both are important and must be effectively blended to have a successful program. Unfortunately, for a country whose industry was poorly managed and resource-constrained and faced with an enemy with a seemingly endless supply of high-quality equipment, the natural tendency to fight mass with mass (matching quantities) overrode the necessity to instill some quality in the airplanes produced.[45]

The result was a large number of inferior aircraft that could not have kept pace with the Allies, even if they were numerically similar. In mortal combat, quality is often the divide between success and failure. This was proven by the Tuskegee Airmen flying bomber escort from Italy. Although the number of P-51s sent to escort a bomber formation did not change drastically, they still escorted more than 200 missions without a single bomber loss. This is attributed to both the skill of these pilots and the quality instilled in the machines they flew. Alas, the Germans did not have the quality in their aircraft to overcome this.

By war's end, the Germans had lost the technological superiority they owned at the beginning. Although this can be directly attributed to their management system, this issue was further exacerbated by their failure to integrate the capabilities of the captured lands effectively. Indeed, rather than capitalizing on the capabilities of the workers in the conquered lands, the Germans merely plundered them and brought their populations into slave labor.[46] They failed to realize and take advantage of what was available to them. The result was a slave workforce that resented its masters. Needless to say, this was another cause of their diminished quality. Finally, as the war progressed, the Germans began conscripting just about any male with a pulse, regardless of his civilian expertise. This led to a lack of skilled workers, without whom quality suffered.[47] This is almost a double tap for quantity over quality—specifically, make the armed forces larger to counter the large force regardless of special (or needed) skills, depriving industry of the skilled workers necessary to instill quality in products sent to the armed forces.

However, equipment was not the only area in which quality suffered. As the war progressed, training for pilots was cut almost in half, primarily because of the need to have replacements for pilots lost in combat. The result was pilots significantly less skilled than earlier groups that entered combat. Poorly trained pilots, flying inferior equipment against a determined enemy on two fronts, is a sure recipe to create an even greater need for replacement pilots. In short, the German economy and industry could not keep up with the demands of a two-front, widely flung war and elected the desperation strategy of throwing everything it had into the fray, regardless of training or expertise. The result is obvious.

Although the complicated nature of industry organization is certainly a contributing factor to the inability of the Germans to exact victory, the lack of management and leadership from the top down definitely compounded the problem exponentially. Without a sound and appropriate strategy or roadmap, anything attempted has the distinct probability of failure. From the beginning, the German strategy focused on Europe and a blitzkrieg style of warfare. As Hitler's aspirations grew (and the war with them), the overall German strategy failed to take these new ideas into account.

Strategizing

From the beginning, the Nazi party rose to power in Germany under the guise of nationalism. Many Germans were still upset over the limitations imposed by the Treaty of Versailles at the end of World War I, in particular the clause that laid the blame for World War I and the resultant carnage squarely on the Germans. Additionally, the German people were adamant about reclaiming the land annexed away from them by the Treaty of Versailles. Undoubtedly, there were also some bad feelings about the French, who were seen as most responsible for the War Guilt clause. Thus, there were some strong feelings of being unfairly and cruelly treated in the aftermath of World War I. This was exacerbated further by the inability of the Weimar Republic to effectively fill the void left by the abdication of the Kaiser. The general disgruntlement of the German people led to a fierce feeling of nationalism and a desire to put someone into power who could actually do something about their situation.

Enter Adolf Hitler, a recognized and decorated World War I veteran who had the charisma and rhetoric to rouse the population. Simply put, he knew what to say and had a forceful enough presence to ensure the people believed him. After his election to chancellor and the death of President Paul von Hindenburg, Hitler combined the two offices into that of Fuehrer and began to attempt to make good on his nationalism pledges. Realizing one of the reasons for the German defeat in World War I was the failure to generate the economy to a war footing, the Third Reich began increasing its economic capability.[48] Ostensibly, this was to continue the nationalistic regaining of indigenous German lands unfairly removed from them. This included the German pushes into Austria; the Sudetenland; Czechoslovakia; and ultimately, Poland. This desire to increase their *lebensraum*, or living space, was risky, however. At any point, the Allied powers (then Britain and France) could respond.

Hitler was emboldened during the operations prior to Poland by the lack of Allied response to his offensives. He assumed they would continue their policy of appeasement after the Poland campaign, especially after he signed a nonaggression treaty with the Soviet Union. Allied appeasement ended with the invasion of Poland, and both Britain and France declared war on Germany. Hitler was ready for this, however, and ordered his troops into France, occupying, in short order, about two-thirds of France.

From here, things began to go south for the Reich, despite their strong army and technological superiority. Up to this point, every campaign engaged in by the Germans had been a blitzkrieg-style campaign:[49] hit the enemy hard and fast to overcome their defenses and then bring them into the Fatherland. As such, the German economy was geared to this type battle. There was reconstitution time between the battles, giving the economy and industry time to recoup the losses. Germany's continental focus was driving its blitzkrieg strategy, and its economy was geared to this. Thus, it produced high-quality, short- and medium-range fighters and bombers in large quantities to accommodate the blitzkrieg of the enemy. Since many of the battles took place within easy distance of Germany, there was no need to delay the production of aircraft to build and stock spare parts; they would just make another airplane to replace the damaged or destroyed ones.[50] While this worked well at the outset of the war, its significance grew as the German battlespace expanded greatly. Compounding this, pilot training was limited to tactical training only,[51] as there was no need to think beyond this level. Yet, with the onset of the Battle of Britain, the Germans changed strategy, whether or not they realized it.

Strategy Shift

World War II might have ended differently had Hitler elected to maintain his *lebensraum* policy and restrict his actions to continental Europe. Nevertheless, he attacked Britain, ostensibly to ensure the British stayed out of the war. From a tactical point of view, this was a huge mistake. To attack London, his fighters

(upon whom the bombers relied for protection) had to operate at the limits of their range if they were to successfully return to France. In other words, he was now fighting a strategic war with a tactical force. Hitler had arbitrarily escalated things, a precursor of things to come.

As the war progressed, Hitler would return time and again to the concept of changing things to fit his worldview *du jour*, with no apparent thought to the impact on either society or industry. The most glaring example of his inconsistency concerns the Me 262, the world's first jet fighter. Originally designed as a fighter, Hitler ordered it changed to a fighter/bomber against the advice of Erhard Milch and Galland. The resultant delay to retrofit the Me 262 to a fighter/bomber ensured that, when it was ready for use as a bomber, the need was for fighters to defend the dwindling Reich. The Me 262, again at Hitler's insistence, was re-retrofitted back to a fighter, another delay to the program that ensured it was not introduced into the war until early 1945.[52] The argument over the Me 262, in which Goering sided with Milch and Galland, marked the beginning of the end of Goering's favor with Hitler. The result was a complete lack of Luftwaffe representation at future meetings.[53]

After the loss in the Battle of Britain, Germany took a pause to recoup its losses; then Hitler made another large strategic mistake—he attacked the Soviet Union. Once again, he escalated the war effort to strategic levels with only a tactical industry and military. The results were disastrous for the Reich. They severely overextended themselves on the Eastern Front, which ensured their already fragile logistics support was stretched too thin. Additionally, the demands on industry for a two-front war were too hard to bear. In short, production could not keep up with losses, and there was almost no way to resupply the troops because of a lack of transport aircraft.[54] Finally, the German leadership severely underestimated the Allies' drive and dedication while simultaneously overestimating their own ability.[55] This ill-equipped armed force with little reconstitution ability, fighting a war that was larger than it was prepared for or capable of, with no clear written strategy and numerous changes to the direction of the effort, would have ensured the Reich imploded. However, the Allies were not content to take the time to allow this to happen. They decided to help it on its way through the Combined Bomber Offensive.

Allied Impact on German Strategy

The Combined Bomber Offensive was a massive push by American and British air forces to provide continuous day and night bombardment of the German homeland, focusing on its industrial capabilities. The American forces were responsible for the daylight bombing, the British for nighttime bombing. The Combined Bomber Offensive almost stopped before it started, primarily because of a lack of fighter escorts for daylight raids. The massive formations of B-17 aircraft were susceptible to the German fighter aircraft, and the resulting losses almost ended this aspect of the offensive. This changed with the introduction of the P-51, a highly maneuverable and capable fighter with range to escort the bombers all the way to their targets. These fighter escorts also served a second function, that of *attriting* the German fighter force—essentially a trench-style slugfest in the air. It was extremely successful in this second role, removing German air superiority over continental Europe and ensuring Allied planes could roam the European Continent with relative impunity.

The effects on the German industry are even more telling. In addition to other targets, the Allied offensive destroyed the German transportation network, severely limiting its ability to operate a dispersed industry. Furthermore, the Allies concentrated their efforts on the critical Ruhr valley, which was the location of German stocks of coal.[56] The coal was used as a power-producing source and critical to the German war industry. The effects of these raids were felt throughout German society and industry as it placed severe hardship on its already overstressed and limited supply of raw materials and transportation. Compounding the German situation, the Allies struck many of its fuel sources. Indeed, in the after-war interrogations, Goering admitted that fuel was a significant limiting factor to production, especially in the production of a four-engine bomber. In discussing the He 177, Goering said, "I had to ground that aircraft because it consumed too much gasoline, and we just didn't have enough for it."[57] Finally, the Allied attacks had a significant impact on the German industry's depots and production facilities.[58] The Combined Bomber Offensive was more than a combination of American and British bombing techniques. It combined with the Germans' inefficient and poorly managed industry to finally break the back of the German war machine.

Summing Up

Throughout the war, the German state was unable to take advantage of many of its indigenous capabilities. Beginning with decentralized control of their procurement process and abetted by a complicated and wasteful fiscal policy, the industry simply could not keep up with the demands of the war. Furthermore, its organizational structure was not conducive to change. Its system of committees and rings with all the subcomponents thereof was an attempt to increase efficiency and reduce cost through standardization of production practices. It actually did not happen that way, as it was a system that could not grow to fit the increased need. The Germans effectively proved that management by committee does not work in a wartime situation. Compounding this further were the people they placed in charge. With a few notable exceptions, the men selected to run the industry were party lackeys who had limited experience and know-how when it came to running an industry.

Strategic direction from the state leadership was completely lacking. What began as a continental campaign to reverse the perceived unfairness of the Treaty of Versailles rapidly expanded into a global strategic battle for world dominance, all with an economy that was geared toward a blitzkrieg-style tactical engagement. German industry was never able to recover from this continental focus, dooming the strategic efforts to failure. Furthermore, the personal and direct involvement of Hitler into all aspects of the war effort only served to confuse and befuddle the national leaders. In other words, absolutely no direction was provided to guide the war effort. This led to numerous production delays as aircraft were constantly fitted and refitted to meet the ever-changing requirements. Additionally, the German leadership had two key misconceptions that may have attributed to their constant change. First, they underestimated the Allies, and second, they overestimated themselves. The added impact of the Combined Bomber Offensive served to exacerbate an already deteriorating situation and helped ensure the 1,000-year Reich lasted a mere 12 years.

Forward to the Future

As the US Air Force begins its fourth major transformation in 11 years, there are some striking similarities between what it currently faces and those challenges faced by World War II Germany. Notable among them is a strong sense of nationalism. No one can doubt the surge in American patriotism since the 11 September 2001 events, and one cannot overlook the sense of outrage and frustration at the horrific waste of human life and American potential. Yet, a parallel can be drawn between this and the general feelings of the average German during the interwar period. The Germans felt a sense of outrage and frustration at not only the loss of land but also the humiliation that accompanied the Treaty of Versailles. In hindsight, these feelings perhaps are justified, but the results for Germany were disastrous. Fortunately, the American people are not following the same political trend, nor could we, given our process for electing our officials and the constraints and restraints placed upon them.

Currently, there is no real centralized control over the US Armed Forces acquisition program. As it was for the Germans in 1935, the US Armed Forces currently follow separate stovepipes for acquisition of weapon systems. There are separate DoD programs for ballistic missile defense among the Army, Navy, and Air Force, as well as different programs for acquisition of unmanned aerial vehicles. The acquisition programs for the F-35 joint strike fighter follow the same path, each service pursuing its own agenda to meet its own needs. This was exactly the same at the beginning of the German buildup for World War II. Each service had its own unique requirements, and each pursued them independently of the other. The result was an egregious waste of valuable and limited resources, both natural resources and dollars. In essence, they ended up paying for essentially the same thing three times. It is the same today with the American military. We have separate programs for the X-45 Air Force unmanned combat aerial vehicle and the X-47 Navy unmanned combat aerial vehicle. Both are experimental, and both operate more or less independently of the other. The end result will be two unique systems that meet specific needs without addressing the overall interoperability between systems. While the Germans were not faced with each branch of the service creating its own flying machine, the overall competition between the Services for constrained resources and the inability of the leadership to differentiate, much less prioritize, among the service requirements led to incredible waste and effort.

Similarly, the US Air Force, today, faces much the same challenge as the Luftwaffe, specifically determination of mission and needs. As the Luftwaffe vacillated between a fighter and bomber, the same struggle goes on today in the US Air Force. With the cost of each individual unit escalating rapidly (because of the investment in technology), what is the priority, fighters or bombers, given that the United States really cannot afford both? Further complicating matters is the need to build tankers and lift aircraft. While the Luftwaffe merely ignored this, to its detriment, this remains a central concern for Air Force officials. While not a concern for the Luftwaffe, the American conundrum is compounded by the oft-overlooked integration of space into the battlespace. The items placed in space are extremely expensive and difficult to make, yet, paradoxically, are always there to aid the warfighters. As long as these systems continue to perform, they will be overlooked largely by people who do not understand their mission or importance until it is too late. All these compete for limited resources, those doled out with a medicine dropper by a dubious legislative branch. This merely compounds the larger issue facing the Air Force today, that of identity.

Transformations

Since 1992, the Air Force has undergone four major transformations. The Air Force has evolved from the Cold War hallmarks of Strategic Air Command, Military Airlift Command, Tactical Air Command, and Air Training Command to the current configuration of Air Combat Command, Air Mobility Command, Air Education and Training Command, Air Force Space Command, and Air Force Materiel Command. Designed to be functionally aligned, each command was changed to be a stand-alone force capable of operating within its own unique and nonoverlapping mission areas. The Air Force then transformed to the expeditionary air forces, an idea that creates ten stand-alone composite forces to handle regional situations worldwide. In essence, the expeditionary air forces are a combination of the functionally aligned major commands of today and the geographically aligned major commands of yesterday. Each air expeditionary force contains strategic and tactical elements yet draws from the respective major commands for expertise. Finally, the Air Force is transforming to a task-force-based concept, which is essentially a subset of the expeditionary air force designed to handle a specific contingency as it arises. All this combines to leave a large uncertainty about the mission and function of an air force.

When asked exactly what it is the Air Force does, the answer depends on when the question is asked or what is going on in the world. In other words, there is limited identity within the Air Force about its mission. This is exacerbated by the fact the corporate identity seems to change with each new Chief of Staff. As Goering's Luftwaffe provided little or no unique identity and mission to its members, so the Air Force faces the same dilemma. The result has been a restructuring of the Air Force from one that can fight an outmoded form of war to one that can survive in an outmoded form of peace. American worldview, like that of the German forces during World War II, has remained stagnant. While paying lipservice to a contingency-based, flexible, expeditionary force, the Air Force remains firmly locked in the planning and budgeting of a Cold War, two major-theater-war mentality.

The one issue the Department of Defense has handled well is the creation of the unified commands. Each command is designed to be a warfighter or a functional command with expertise in either a particular area of responsibility or a particular function. There is no overlap in responsibility (except for the functional commands, which operate somewhat autonomously of the geographic commands), yet each of the unified commands manages to share resources and information without regard to which component provided it. In many ways, this mentality needs to transcend the programmatic stovepiping in each of the military branches.

The issue of technology is becoming the forefront of American procurement and acquisition issues. As the Germans did in 1935, America now enjoys a technological superiority over friend and foe alike. At the present, there is no match for American technological know-how and application. Yet, this technology is only as good as its application. As the Germans found out,

developing technology just because you can is a poor reason to carry out a government program. While the Germans had some technological innovations, such as jet engines and wind tunnels, many of their technological advances were not realized until after the Reich had vanished. Indeed, developments such as the Gotha P.60 flying wing-style fighter were not adopted until recently with the advent of the B-2 Spirit. The German programs were mismanaged from above almost from the start, including no boundaries on where technology could go. The American problem is more geared to including technology into *simple* problems, simply because it is possible. Many of the acquisition programs undertaken by the Air Force fail to consider the *low technology* or already existing technology approach, often at a large pricetag for a limited capability.

Further complicating the picture is the management of our acquisition programs. In most cases, for a new system, it can take 10-20 years from identification of the problem to fielding a system to defeat or answer the problem. Often, the items fielded are obsolete before they enter production because of changing world needs. Granted, the Department of Defense has not fallen into the pitfall that awaited the Germans; namely, changing existing programs to meet evolving needs. However, the Department of Defense tends to create a new program to handle a problem, which significantly compounds the ability to field forces capable of responding in the manner in which they are needed. Each of these programs will compete for existing, limited funds, resulting in a compromise that answers neither the existing problem nor the original problem. Additionally, the acquisition process is bureaucratically robust. Very little can overcome the inertia of the albatross (the bureaucracy) surrounding acquisition programs, and nothing gets through quickly. The Department of Defense has so many layers of management to get through that it becomes almost a self-licking ice cream cone when faced with an immediate and unforeseen threat. In certain rare circumstances, this inertia can be overcome, but these are the exceptions rather than the rule.

Finally, the American worldview is stagnant. As the Germans could not see beyond continental Europe, so the Americans cannot see below the strategic layer. The Germans could not see the forest for the trees, and America cannot see the trees for the forest. America still believes, despite the 11 September attacks, that it cannot be touched by a foe. Americans believe the way to counter potential foes is to apply a strategic, precision, lethal force. This may be true when it is a contest between nations, but in a contest between a nation and a nonstate actor, this meets limited success. Thus, America's worldview and its Armed Forces must be ready for strategic and tactical wars, both conventional and unconventional.

The real answer lies in establishing a warfighting entity that is impartial with respect to the Services' ability to handle the acquisition and technology programs for the entire Department of Defense. The logical choice is to place the integration of all military needs under the unified command tasked with determining the training and evaluation needs for joint forces, United States Joint Forces Command. With its overarching view of all the unified commands, it is in the unique position to determine what is necessary to fight and win America's wars, both in terms of manpower and equipment. Furthermore, it should be charged with ensuring the interoperability of these programs to meet service-specific needs with minimal changes. In this time of limited resources and increasing needs, standardization is required without sacrificing individual service-unique needs. Additionally, a streamlining of the acquisition process is required to ensure timely answers to emerging needs. Without these changes, our system becomes almost as cumbersome as the World War II German system, a system that can (and in the case of World War II, Germany, did) implode if left alone long enough.

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49. Baumbach, 34.
50. Lee, 256.
51. Faber, 141.
52. Baumbach, 171.
53. Price, 183.
54. *The Rise and Fall of the German Air Force, 1933-1945,* New York: St Martin's Press, 1983, 407.
55. Baumbach, 30.
56. Milward, 172.
57. US Strategic Bombing Survey, Interview No 56, 4.
58. Lee, 266.

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(Improving Bare-Base Agile Combat Support from page 15)

17. Boley, 55.
18. Todd Groothuis, "Afloat Prepositioning of Nonmunitions WRM Phase II," Air Force Logistics Management Agency Report LX200125700, Apr 03, i.
19. Groothuis, 22.
20. Groothuis, 24.
21. *Ibid.*
22. Groothuis, 25.
23. *Ibid.*
24. Groothuis, 26.
25. *Ibid.*
26. Groothuis, 27.
27. The final leg of truck to destination is descriptive of the fact that once an item arrives at an aerial port it still has to be moved to an operating location.
28. Groothuis, 15.
29. Boley, 27.
30. HQ Air Force/Installation and Logistics Briefing, "Bare-Base Systems Status Update–Harvest Falcon and Harvest Eagle," Slide 20 [Online] Available: http://140.185.52.73/ilx/ilxx/wrm/index.html, May 03, slide 20.
31. GAO, "Military Prepositioning: Army and Air Force Programs Need to Be Reassessed," GAO/NSIAD-99-6 Nov 98, 41.
32. *Ibid.*
33. *Ibid.*
34. HQ AF/IL Bare-Base Systems Update, slide 34.
35. HQ AF/IL Bare-Base Systems Update, slide 33.
36. The WRM facility at Al Udeid, Qatar, was used for lodging during the initial stages of Enduring Freedom while the Harvest Falcon kits were being readied for use.
37. During the buildup for Iraqi Freedom, planners were unwilling to discuss the use of local hotels in Doha, Qatar, to allow for a faster force closure at Al Udeid AB. Instead, a 4-month delay was allowed for the contracting of tents, latrines, and other infrastructure additions to Al Udeid.
38. Boley, 42.
39. HQ AF/IL Bare-Base Systems Update, slide 14.
40. Boley, 54.

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(*Creative Approaches to Improving Segments of the Defense Transportation System* continued from page 33)

RDD of 444 indicates handling service for customers collocated with the storage activity or for locally negotiated arrangements. An RDD of 555 indicates exception to mass requisition cancellation, expedited handling required. An RDD equal to 777 indicates expedited handling required for reasons other.
21. DoDR 4140.1-R.
22. Author's telephone interview with TACC/XOGE, 17 Feb 04.
23. Author's e-mail interview with HQ USTRANSCOM, J3-RR, 18 Feb 04.
24. Capt Leigh Method, letter report, Time-Definite Delivery Estimates for DoD Air Shipments, AFLMA Project Number LT200011000, Oct 00, 2.
25. Author's telephone interview with HQ USTRANSCOM/TCJ4, 28 Jan 04.
26. Area A. To locations in the vicinity of Alaska (Elmendorf AFB), Hawaii (Hickam AFB), North Atlantic (Thule AB, Greenland, and NAVSTA Keflavik, Iceland), and the Caribbean (NAS Guantanamo Bay, Cuba, and NAVSTA Roosevelt Roads, and Puerto Rico). Area B. To locations in the vicinity of United Kingdom (RAF Mildenhall, England) and Northern Europe (Ramstein AB, Germany and Lajes AB, Portugal, Azores). Area C. To locations in the vicinity of Japan (Yokota AB and Kadena AB, Okinawa), Korea (Osan AB), Guam (Andersen AFB), Western Mediterranean (Spain (NAVSTA Rota), and Italy (Aviano AB, NAS Sigonella, Olbia, and Naples). Area D. Hard lift areas—all other destinations not listed as determined by USTRANSCOM; for example, low-use Alaska (Eielson AFB, Adak, Eareckson AS, and Galena), low-use Japan (Itazuke, MCAS Iwakuni, Misawa AB), low-use Korea (Kunsan AB and Kimhae), Indian Ocean (Diego Garcia), New Zealand (Christchurch), Singapore (Paya Lebar), Greece (Souda Bay), Turkey (Incirlik AB), Southwest Asia (Saudi Arabia (Dharan and Riyadh), Kuwait, Bahrain, Oman (Fujairah), and Israel (Tel Aviv). The time standards for port of debarkation for Area D are lower than the other areas. EXP. Commercial door-to-door air service is only for OCONUS shipments that are transportation priority 1 or 2. It is an alternative service to be used when established AMC channel service is not adequate. The intransit-to-theater standard for commercial door-to-door air service (that is, segment H) encompasses the total time for contract transportation rather than individual nodes.
27. Table AP8.T1 from Appendix 8 of DODR 4140.1-R.
28. Appendix 8 of DODR 4140.1-R
29. US Government DoD Airlift Rates, Passenger and Cargo Channel Rates Effective 1 Oct 03 through 30 Sep 04 [Online] Available: http://public.amc.af.mil/fm/dodrates.doc)(http://public.amc.af.mil/fm/fy04dod.pdf.
30. Roger O. Crocket, "Let the Buyer Compare," *Business Week*, 3 Sep 01, Issue 3747.
31. GAO Report 04-305R, Defense Logistics: Preliminary Observations on the Effectiveness of Logistics Activities during Operation Iraqi Freedom, 18 Dec 03, 2.
32. GAO Report 04-305R, Preliminary GAO Observations on Effectiveness of Logistics Activities During Operation Iraqi Freedom, 18 Dec 03, Enc 1, 22.

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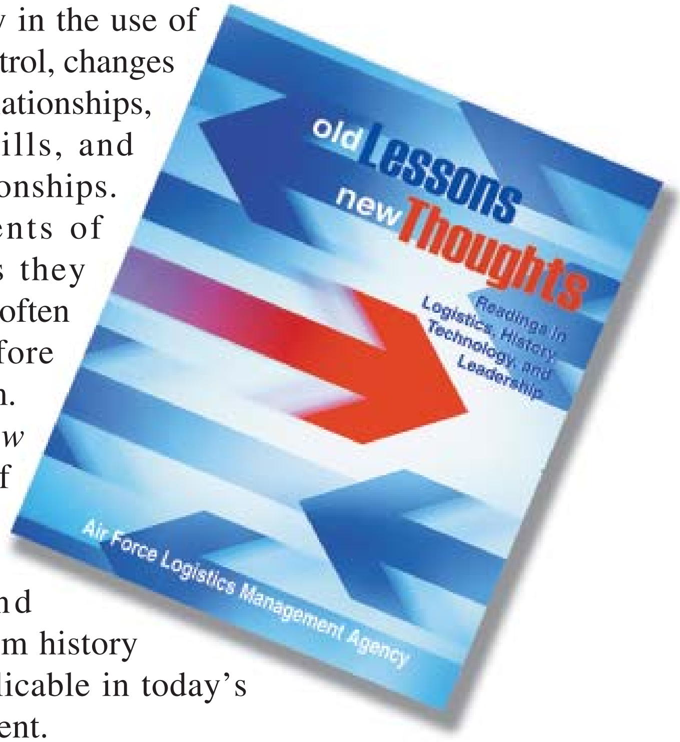

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